RAILROAD GAZETTE

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Contributions

The Turning Moments of Four-Cylinder Balanced Compound Locomotives.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The contribution of Mr. J. V. N. Cheney (*Railroad Gazette*, Jan. 29, 1904, p. 73) to the discussion on the above subject leads the writer to believe that though much has been written about the four-cylinder balanced compound locomotive in our various technical publications, the fundamental principles on which this design is based are not yet clearly understood by some locomotive engineers.

Mr. Cheney asks the question: "Allowing (cranks) Nos. 1 and 2 to be doing 7,000 lbs. each, would not the rotative effort be as uniform if the work of the two was combined on one crank, making 14,000 lbs. acting on the one crank?" The rotative effort would not be *as uniform*, because the period of steam admission in the former instance is very seldom less than half the stroke of the cylinders and more frequently 60 per cent. to 75 per cent., whereas in the latter case it is generally 15 per cent. to 25 per cent. of the stroke, at fairly high rates of speed. In other words, in the four-cylinder compound locomotive the pressures on the crank pins are constant through almost the entire stroke, and the sudden drop of pressure in the cylinders occurs only in the last quarter of the stroke, when the acceleration of the reciprocating parts is at its maximum and thereby compensating the decreased pressure on the piston near the end of the stroke. In the two-crank locomotive, however, the initial maximum pressure on the crank pin (viz., at the beginning of the stroke) drops considerably before it has even reached the upper or lower vertical position, when the crank should exert the maximum turning effort.

It follows clearly from the above analysis that the rotative effort in the four-cylinder balanced compound locomotive is *more uniform* than in the two-crank. However, it is not due to this fact alone that the rotative effort of the four-cylinder balance compound approximates nearly that of the electric locomotive, but also from the fact that the greater uniformity of the crank-pin pressure, or all of the crank-pin turning effort, is fully utilized at the tread of the wheel, which, in virtue of the setting of the cranks of the adjacent high and low-pressure cylinders at 180 deg., permits of a perfect vertical equilibrium of the driving wheel at its highest speeds. It is due to the combined effect of the above two factors that, as Mr. Coster has well pointed out in his communication to the *American Engineer*, the steam locomotive (the four-cylinder balanced compound) makes the nearest approach in efficiency to the electric locomotive as an adhesive tractive machine.

Mr. Cheney agrees with "Q. E. D." that the four cranks in the four-cylinder balanced compound locomotive are "not set at right angles" and offers a panacea for this grave error by having "the crank axle No. 2 (right side) set at 90 deg. with No. 1, the crank axle No. 3 (left side) set at 90 deg. with No. 2, and the pin No. 4 set at 90 deg. with No. 3. By this arrangement the torsional stress is more evenly divided between both ends of the axle. Of course, this arrangement would change the system from the 'Woolf' to the receiver system, which is not necessarily an objection to this arrangement, while the *balancing effect* is still preserved."

I wish to remark, *en passant*, that except the Santa Fe four-cylinder balanced compounds, all Continental designs are, to my knowledge, of the receiver type, but I would wish to ask Mr. Cheney to explain to your readers how, with his arrangement of cranks as above described "the balancing effect would be still preserved?" The most important claim that is made for the four-cylinder balanced compound is that the cranks of the adjacent high and low-pressure cylinders are set at 180 deg., or very nearly, so that the reciprocating parts of these two cylinders may thereby be nearly perfectly balanced. It is well known that just as a revolving weight can only be balanced by an equal revolving weight so a reciprocating weight can only be balanced by another equal reciprocating weight, but moving in an opposite direction and at equal speed. All other systems of "balancing" the reciprocating parts in a locomotive engine are mere makeshifts, which can only minimize the inertia effects, but never counterbalance or annihilate them.

The four-cylinder divided-balanced compound, when properly designed and built, solves an important locomotive problem, which hitherto we have treated as two distinct and independent problems.

C. M. M.,
Member American Railway Master Mechanics' Assn.

A Study of Failures of Re-enforced Concrete.

St. Louis, Mo., Jan. 28, 1904.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In reply to the article on page 60 of the *Railroad Gazette*, January 22, under the above title: Mr. Kahn seems to consider himself as the original discoverer of the shearing stresses in re-enforced concrete beams, which he seems to have made about a year ago, more or less. The writer protests that this is hardly fair, when he knows of a number of prominent firms in this country and abroad who have been taking care of these stresses in their own work for the last eight years. It might be more proper to say that Mr. Kahn was the last to learn of them. The writer's company had published a catalogue in which these matters were discussed, and formulæ given for indicating when provisions against shear was to be supplied, some months before Mr. Kahn had found himself.

Concerning some ridiculous expanded metal floor construction referred to in this article, the writer wishes to state that there are a large number of expanded metal companies throughout this country, all of whom design their own work, and they have nothing to do with each other. Some of them, of which the writer's company is one, are not on good terms with the others, and have no knowledge of what they are doing. That some of them have not employed competent engineers has been shown in a number of cases, and the writer objects to being placed in the same class with them.

With what Mr. Kahn says about the necessity of competent advice in the design and execution of steel-concrete structures the writer fully concurs, but he does not follow him to the extent of saying that Mr. Kahn for the one and his bar for the other, are essential to success.

So far as Mr. Kahn is concerned, he makes the mistake of assuming that all steel-concrete beams fail by shear. It depends upon the ratio of height to length, and the character of the loading, just as in any other kind of beam.

He makes a further mistake in his discussion of the shear in the beam illustrated in Fig. 1 of the article referred to. The safe carrying capacity of such a beam is not 25,000 lbs. of uniformly distributed load, as he states, but just one-half of this, or 12,500 lbs. The former would be the safe-carrying capacity for a beam of the depth shown, 12 in. wide, but his beam is only 6 in. wide. The above values are based on a factor of safety of 4, and the ultimate carrying capacity, then, should be 50,000 lbs., instead of 100,000 lbs., as he states. He also says that assuming a safe-shearing stress of 50 lbs. per sq. in., the cross-sectional area being 120 sq. in., "that the beam would only carry a safe load of 600 lbs. in shear," and he makes a comparison between this and the 25,000 lbs. safe load against bending, giving an apparent discrepancy of 1:4 as between the strength against shear and the strength against rupture by bending. The 6,000 lbs. above mentioned is not the safe load on the beam against shear, but the reaction at one end under such safe load, the load itself being twice this, or 12,000 lbs., and the comparison should be made between this 12,000 lbs. and the 12,500 lbs., the safe load for the bending moment. In other words, the safe load that he gives against shear is only one-half what it should be, and the safe load against bending is twice what it should be, and the values, instead of showing a ratio of only 1:4, are, in fact, practically equivalent. He says, later on, that he has not obtained shearing results on concrete larger than 250 lbs. to 300 lbs. per sq. in., which indicates that he has taken a factor of safety of 5 on shearing and 4 on bending. If we compare the ultimate moment of resistance of such a beam with the ultimate shearing strength as indicated by these values, we will have a maximum ultimate shear at one support of $250 \times 120 = 30{,}000$ lbs., giving a load-carrying capacity of 60,000 lbs. on the beam, as against the maximum load possible to develop by the moment of resistance of 50,000 lbs. By the above discussion, therefore, using Mr. Kahn's own figures and simply correcting them where they are manifestly in error, it is evident that the statement made in the last sentence of the paragraph to the effect that "it is evident that a beam thus re-enforced is exceedingly weak in shear," is not warranted. Of course, such a discussion as the above has no pertinency whatever to those who have any knowledge of the maximum shearing stresses in re-enforced concrete beams, and the fact that Mr. Kahn should take the trouble to develop, however carelessly, the shearing stresses in the vertical section, merely indicates that he has no real knowledge of how or when the maximum shearing stresses in such beams are developed.

So far as his bar is concerned, if each wing were separated from the rectangular middle portion the latter allowed to pass horizontally to the end of the beam, and the side rods have their ends bent up, one having the bends at the quarter point, and the other between this and the end, we would have the equivalent of the Kahn bar for nearly all conditions in practice, wherein the maximum load is seldom a concentrated load. In fact, the use of separate rods in this way, which is the common practice, besides being cheaper, has the advantage of permitting the separation of the parts so as to have each part entirely surrounded by concrete. Besides negative advantages, his bar has certain positive disadvantages. For example, in the usual case of maximum load being approximately uniformly distributed, the necessity for shearing provision occurs only adjacent to the supports. For this case, the Kahn bar would then have a considerable length in the middle, wherein dependence would have to be placed upon the adhesion, which he admits is not wise. To obviate this by cutting the wings, and bending them up, from end to end, involves a heavy loss in metal. Furthermore, the bar must be symmetrical around the middle portion, and hence must be prepared in advance for a particular place, and cannot be economically used in other places.

In floor construction, the usual practice of good companies is to let half the bars run through horizontally and half bend up from about the quarter point, and hook over the supporting girder beams. Taking a flat slab design, the writer's tables give, for 12-ft. span, using cinder concrete, a 6-in. slab, with .3 sq. in. of metal per foot of width, as capable of carrying 615 lbs. per sq. ft. ultimate load uniformly distributed. The writer never heard of such a construction failing by shear, though the total load is twice what it would be if the beam were simply supported at the ends. The writer has made numerous tests himself on such work, and knows that this is true.

In some eighteen beams recently tested at the Rose Polytechnic Institute, by Professor Malverd A. Howe, ranging in size from 5 in. deep x 12 in. wide and 10 ft. span, to 21 in. deep x 12 in. wide and 18 ft. span, three failed by shear at the ends, within about 15 per cent. of the ultimate strength in bending, the others giving beam breaks. With regard to these three, the tests on compression blocks indicate that most of this discrepancy was due to the concrete not having the theoretical crushing strength assumed. But deep beams will fail by shear unless provisions are made to take care of the shearing stresses, which all responsible companies understand, as they are also aware that they are not dependent in the future, as they have not been in the past, upon a Kahn bar to obtain these results. Professor Howe will no doubt wish to write up his own investigation, and the writer does not wish to anticipate him by giving the details at this time. Suffice it to say that they will show that there are several roads to Rome.

A. L. JOHNSON, M. AM. SOC. C. E.

Present Status of the Wabash Tidewater Extension.

Hambleton & Co., of Baltimore, in their weekly news letter, print the following resumé of the present outlook for the proposed Wabash extension to tidewater. It is probably substantially correct.

The old question of the settlement between the Pennsylvania and the Gould-Wabash interests continues to crop up, and there are apparently some reasons for believing that while an understanding may not have been agreed upon it is quite possible some arrangements to harmonize the interests of these rival properties will be reached. We have always taken the ground that the Wabash people would not be satisfied unless they could reach New York, and indications seem to point to a confirmation of our views on this subject. Of course, the terminal of the Western Maryland will be built. This would be desirable under any conditions, and it is also possible—although not at all certain—that the link between Cherry Run and Cumberland may be built. There is no evidence, however, that the Wabash system of roads will take any steps whatever to connect that system with either the West Virginia Central & Pittsburg or the Western Maryland. The proposed route via Parkersburg has evidently been abandoned—a route, by the way, so far as any Atlantic terminal outlet for the Wabash was concerned, was quite impracticable, if not altogether impossible; and we do not hear that any preliminary surveys have been made looking to the building of the Wabash from Pittsburg to a connection with the Western Maryland at Chambersburg or Cherry Run. Even if such connection should be made later it would require the regrading and rebuilding of the Western Maryland—a very serious undertaking; and, if all that were accomplished, the terminus which has been selected at Baltimore would be one suitable only for the re-shipment of products by water routes; the locality is so far distant from the center of the city as to make it impracticable as a terminus for passenger or general freight business. What we anticipate is that the West Virginia

Central & Pittsburg and the Western Maryland will be used as a coal road, and that the Wabash's real intention will develop into obtaining an entrance into New York over some other route—probably the Pennsylvania.

The Pennsylvania Railroad Tidewater Terminal at Greenville.

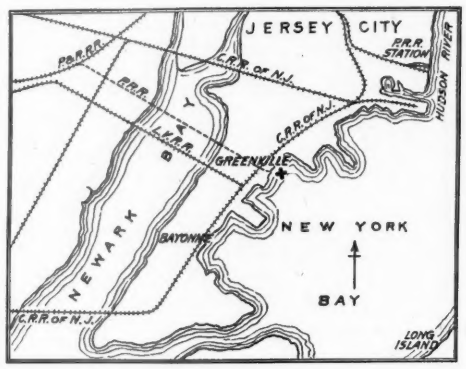
In the *Railroad Gazette* of March 27, 1903, Mr. Whinery gave a short description of the plans of the Pennsylvania Railroad for handling its enormous freight business in and about Jersey City. Although some of the details of the improvements spoken of have not yet been definitely decided upon, work has been going on for some time, and the more important features may be given now.

The company secured some years since a large tract of submerged land on the New Jersey shore at Greenville, about 3½ miles south of the Pennsylvania R. R. station at Jersey City. The tract extends out into New York bay to the established pier line, a distance of about 1.8 miles. It will have a water frontage of 1,900 ft. and a land frontage along the present shore line of about 2,600 ft. The distance between the pier line and the bulkhead line is over 4,400 ft. long, thus allowing piers to be built more than four-fifths of a mile long. The area of this submerged portion is 550 acres, and of the total, the land between the bulkhead line and the shore line amounts to 350 acres.

For some time past the company has been dredging and filling in the portion between the bulkhead line and the shore line, and about 75 per cent. of the work is now completed. It has taken approximately 8,000,000 cu. yds. of earth to raise this submerged land to the present level. Mean low water between the shore and the bulkhead line ranges from a maximum depth of 5½ ft. to a minimum depth of 2 ft. When the filling in process is completed the land will be about 40 ft. above water level near the shore and about 10 ft. above the water level at the bulkhead line. On this redeemed tract west of the bulkhead will be built a terminal freight yard, the general plan of which is given here. The east-bound tracks will be laid out with a hump for gravity switching, having a prevailing grade of one per cent. from the apex of the hump to the first switch, and a falling off to .6 of one per cent. from the last switch to the yard level. As shown on the accompanying plan, this method does away with practically all cross-over tracks, thereby greatly facilitating the distribution of cars.

The yard will be divided into four parts, or two sets of east-bound and west-bound tracks, all converging to lines leading to three transfer bridges and a lighterage pier. Ample space has been reserved for car repair tracks, storage tracks, an icing yard, quick unloading yard, and a thoroughfare track for cripples. North of the main yard, tracks have been provided for in-bound and out-bound locomotives, leading to a 75-ft. turntable, a coaling station and engine storage tracks. East of the bulkhead line work has been begun on three apron transfer bridges and a lighterage pier. Each of these bridges will be 350 ft. long, with three tracks, and an unloading capacity of 22 cars. The lighterage pier will be 1,000 ft. long and will have eight tracks. About 300 ft. of this pier has already been built. By means of these bridges, cars will be delivered to transfer boats for distribution to various points in New York harbor, including the Long Island Railroad and the New York, New Haven & Hartford. This work is being directed under the supervision of W. C. Bowles, Engineer of Construction.

The railroad company has also acquired a strip of land 400 ft. wide, extending from the above described tract westward across the peninsula to Newark Bay, a distance of about a mile. Rights of way have also been secured for the extension of the New York Bay Railroad from the main line to and across Newark Bay to the above-described property. This line will cross the bay to the north of the Lehigh Valley tracks, as shown in the accompanying map. On this tract of land a receiving yard will be built, but the plans for this have not yet been settled upon. The company is also making preparations to build a ferry-house at Gates avenue, Greenville, from which boats will run direct to Cortlandt Street, Manhattan.



Map Showing Location of Pennsylvania R. R. Improvements at Greenville.

Gas Engines in Railroad Work.*

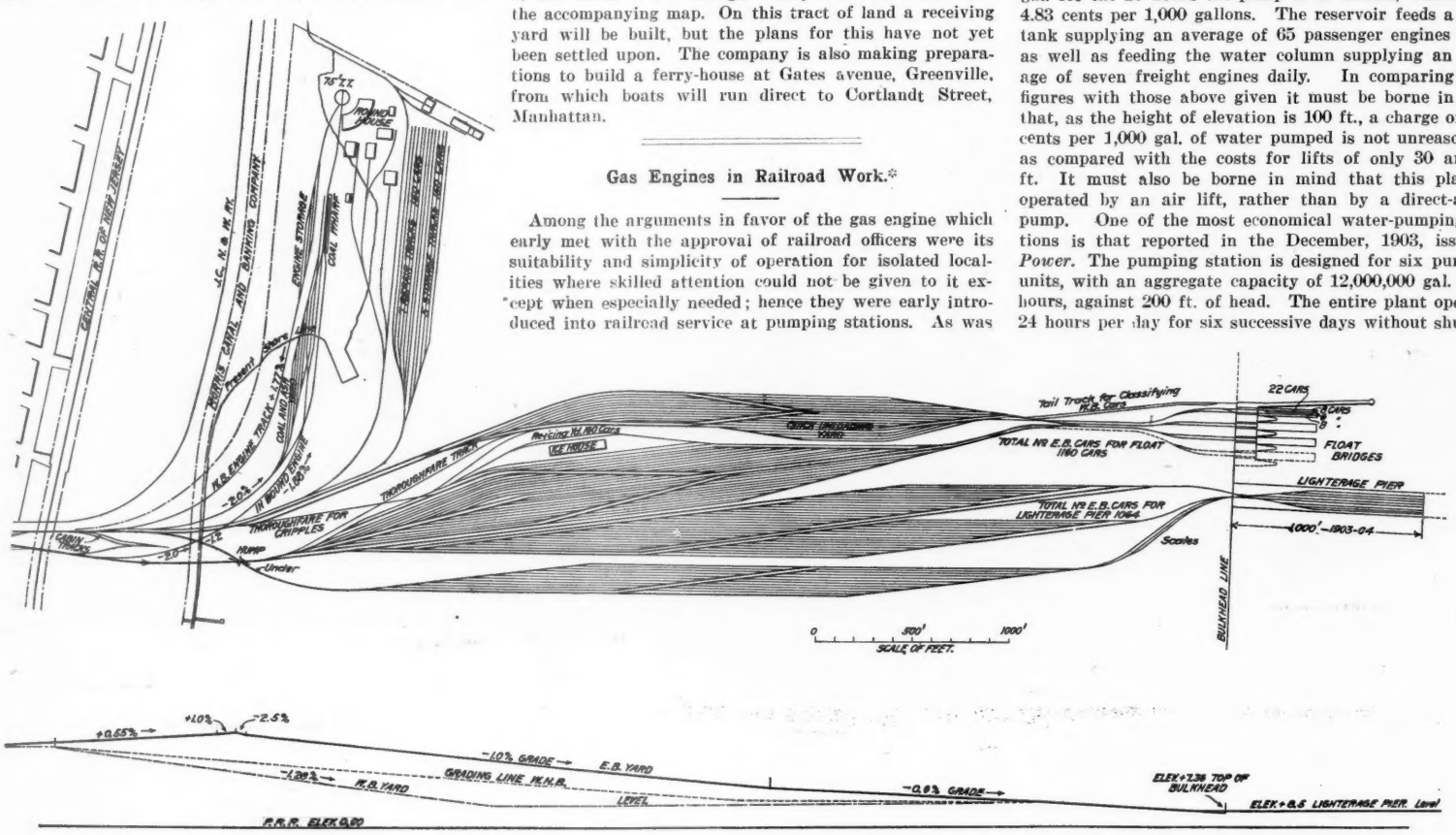
Among the arguments in favor of the gas engine which early met with the approval of railroad officers were its suitability and simplicity of operation for isolated localities where skilled attention could not be given to it except when especially needed; hence they were early introduced into railroad service at pumping stations. As was to be expected, they met with the prejudice and opposition commonly accorded to new machinery, especially as the continuous services of a fireman were no longer needed. The engine could be started in the morning by the station agent, or by a track walker, and left to do its work until it was automatically stopped when the tank became filled, or until it was stopped by the same attendant at noon or at the end of the day. Such plants have been installed in large numbers by the railroads, more particularly in the Central States and in the more sparsely settled west. One line is said to have 127, 10-h. p. engines of one make in service in the far northwest, where they have been found to be superior to any other power, as skilled labor is not required to take care of them. From a report on "The Best and Most Economic Plant for Pumping Water for Water Stations," presented at the ninth annual convention of the Association of Railway Superintendents of Bridges and Buildings, which met in Detroit, Mich., Oct. 17-19, 1899, the following quotations were made. "The cost of gasoline per 1,000 gal. of water pumped varies from .62 cent to 1.38 cents. At one station, the average cost for the month of the gasoline used in pumping 1,000 gal. at the rate of 4,000 gal. per hour through a vertical suction lift of from 10 to 25 ft. and a vertical discharge of 35 ft. and a horizontal discharge of 300 ft. was 1.04 cents. The wages of the pumper per 1,000 gal. was 1.09 cents. By comparing the costs of a number of water stations it was found that the average total cost of delivering 1,000 gal. into tanks for ten gasoline engine pumping plants was 1.51 cents, while the average total cost for eight steam plants was 5.45 cents." The figures are taken from the reports of five railroads. One of the members of the committee making the report stated that water at that time could be pumped as cheaply with coal delivered in the pump-house at 60 cents per ton as with gasoline at 10 cents per gallon, considering fuel alone. The cost of repairs is said to average about $1 per month per engine, including the cost of the renewal of batteries. From the above it will be seen that not only is there in many cases a saving in the cost of fuel required, but that the greatest saving is in the cost of labor. One of the eastern roads has in use an air displacement pump, concerning which the general superintendent has kindly given me the following data.

The road has in use a 65-h. p. Otto gas engine used for the operation of an Ingersoll-Sergeant belt-driven duplex air compressor, and operates a Merrill duplex displacement pump with a capacity of 250 gal. per minutes, the discharge from which is forced through an 8-in. pipe, 2,700 ft. long, to a height of 100 ft., from a well fed by a running stream to a reservoir on top of a hill. The plant is in service on an average of 20 hours daily and its operation, we estimate, costs as follows:

Gasoline consumed in 20 hours, 90 gallons, at 11½ cents	$10.35
Dynamo oil, 1 quart, at 12½ cents	.125
Red engine oil, 3 quarts, at 3 cents	.09
Wages of pump men, 2 men, 12 hours each, at $1.925	3.85
Oil, tallow and waste	.09
	$14.505

We pump 250 gal. of water per minute, or 300,000 gal. for the 20 hours the pump is in service, which costs 4.83 cents per 1,000 gallons. The reservoir feeds a track tank supplying an average of 65 passenger engines daily, as well as feeding the water column supplying an average of seven freight engines daily. In comparing these figures with those above given it must be borne in mind that, as the height of elevation is 100 ft., a charge of 4.83 cents per 1,000 gal. of water pumped is not unreasonable as compared with the costs for lifts of only 30 and 40 ft. It must also be borne in mind that this plant is operated by an air lift, rather than by a direct-acting pump. One of the most economical water-pumping stations is that reported in the December, 1903, issue of *Power*. The pumping station is designed for six pumping units, with an aggregate capacity of 12,000,000 gal. in 24 hours, against 200 ft. of head. The entire plant operates 24 hours per day for six successive days without shutting down, and on Sundays at least three engines are in service. The operating force consists of one engineer on each day and night run respectively, it being found that the attendance of one man was quite sufficient for the operation and maintenance of the entire plant in a satisfactory manner. Up to the present time no troubles of any importance have developed, and no interruption of service has been experienced. The cost of the plant, including building, intake, etc., is approximately $100,000, or $240 per brake horse-power. The fixed charges per month, including the interest on the investment, depreciation and repairs are estimated at $1,125. The operating cost per month amounts to only $405, and consists of $130 for attendance; $95 for oil, waste and supply, and $180 for natural gas of 1,000 B. T. U. calorific value, at 8 cents per 1,000 cu. ft. The operating cost per million gallons is $1,855. The total cost per million gallons is $7.02, or a total cost of seven mills per 1,000 gallons pumped into the reservoir against 200 ft. of head. The operating cost per horse-power delivered per hour is 2.05 mills, while the total cost per horse-power delivered per hour is 7¾ mills.

It seems to be the impression among railroad men that the gasoline engine may be all right for small pumping plants, and where the price of coal is high, but that in larger installations a steam plant is preferable. The Rock Island has just installed for their new shops a pumping plant at East Moline, Ill., consisting of a 60-h. p. gasoline engine, direct-connected to a 1,000,000-gallon pump, and also a 60-h. p. high voltage motor similarly connected to another 1,000,000-gallon pump. As this pumping plant is about two miles away from the shops, it is to be



Plan and Profile of Proposed Tidewater Terminal Yard of Pennsylvania Railroad at Greenville.

*Extracts from a paper by William T. Magruder, Professor of Mechanical Engineering, Ohio State University, read at the annual meeting of the Central Railway Club, at Buffalo, N. Y., Jan. 8, 1904

hoped that some valuable information will be obtained as to the relative costs of pumping large quantities of water by gasoline power and by electric current. If the plant is such a large one that the services of a pumper are constantly needed, then a cheaper fuel than gasoline should be used, and either a suction gas producer or an oil gas producer should be installed. By this means the total cost of operation can be reduced by the difference in the cost per horsepower of the coal used in a boiler, and the coal or oil used in a producer. It is not considered wise to allow the gasoline plant to be without attention for over four or five hours at a time, as the delay to train service by lack of water at the pumping station due to a break-down of the gasoline engine or pump would be more costly to the company than the services of a pumper for many days. It should be borne in mind, however, that there are certain spare parts which every gasoline pumping station should always have at hand, such as extra battery parts, ignition points, springs and lubricating devices, just as there should be extra or spare parts at a steam pumping plant for use in case of sudden break-downs. Many vexatious and expensive repairs can be prevented by the installation of an engine and pump of high grade. In this, as in many other lines of industry, the machine lowest in first cost is not necessarily the cheapest. A certain number of parts are necessary to every engine or machine, and the builder who saves the purchaser the expense of a few dollars by omitting these parts frequently causes him to spend several times the amount so saved in extra fuel required and in more frequent repairs. On the other hand, the best engine does not necessarily have to have an excessive number of parts, and usually such an engine is liable to easily get out of order. Each part of a gas engine or other machine should have a definite object for its existence, and a definite duty to perform, for which it should be suitable in both strength and material. If continuity of service is desired in a railroad pumping station, it may not be necessary to install an engine such as is required for generating of electricity; but, on the other hand, to install one of the type of engines usually found in the oil fields would be the height of folly, as their construction and finish is usually such that their life is short and directly proportional to their first cost as compared with other engines, while their fuel consumption may be outrageously high. This last is a point of little moment in the case of a pumping engine in the oil fields, using a surplus of fuel, but it is one which cannot be overlooked where the fuel has to be transported and handled several times, as in railroad work. For railroad work, the best machine in use is a good serviceable engine of sufficient weight, run at a piston speed preferably of 500 f. p. m., and not to exceed 600 f. p. m. with electric ignition, and the hit-or-miss system of governing.

There should be no difficulty in securing unadulterated gasoline of the proper specific gravity, for while the introduction of the use of motor vehicles has created a large demand for gasoline, and has caused the price to increase, it has also brought much skilled attention to the construction of gasoline engines, which it is estimated reduced the gasoline consumption per horsepower fully 30 per cent. in the year 1901. It may truthfully be said that the increase in the demand for gasoline has been accompanied by a decrease in the cost of gasoline used per brake horse-power-hour. In the transportation and handling of gasoline there should be no more likelihood of danger in the handling and transportation than there is in the use of coal in the locomotives or fire in the stoves of passenger coaches and cabooses. The chief danger is in case of wrecks.

In Vol. XII. of the Proceedings of the Association of Superintendents of Bridges and Buildings will be found a report on the use of gasoline engines for operating turntables on the Lehigh Valley, which gives much interesting data. In a reply to a recent letter of inquiry, Mr. F. E. Schall, Bridge engineer of that road, states that they have "Five 75-ft. turntables equipped with gasoline engine motors, and one 64-ft. turntable with electric motor; all are giving entire satisfaction."

COST OF OPERATING TURNTABLES FOR ONE YEAR.

Lehigh Valley Railroad.

Place.	Length.	Motor.				No. of eng. handled.	Av'g cost.	Av'g cost per
	ft.	Size.	Kind.	Maker.	Installed.	Per day of 24 hr.		eng. handled.
Coxton	64	5 h.p.	Gasoline	F. M. Co.	7/01	170	$3.78	2.22 cents
East Buffalo	75	5 h.p.	Gasoline	F. M. Co.	4/02	110	3.40	3.09 cents
South Easton	75	5 h.p.	Gasoline	F. M. Co.	3/02	194	3.55	1.83 cents
Lehighton	75	5 h.p.	Gasoline	F. M. Co.	2/02	121	3.41	2.90 cents
Wilkesbarre	75	5 h.p.	Gasoline	F. M. Co.	3/02	46	2.91	6.50 cents
Sayre	64	20 h.p.	Electric	G. E. Co.	6/02	140	3.99	2.85 cents

From the above it will be noticed that the cost per day for operating turntables varies very little, but the cost per engine, of course, will vary with the number of engines handled. The cost noted includes all labor, supplies and repairs, but does not include interest or depreciation, which would amount to about 45 cents per day. The cost of installing one of the gasoline motors or electric motors is from $1,000 to $1,200 complete and ready for operation. The cost of operation by power is considerably less than by hand, especially for tables where very heavy engines have to be turned. There is also a great saving in time which cannot be expressed in dollars and cents, but at a busy table is an important item.

It is to be noted from the above that a 20-h. p. electric motor is used at the Sayre turntable, and that the total cost per day was $3.99 in turning 140 engines; while at the Coxton turntable, which is next highest, the cost per day with a 5-h. p. gasoline motor was $3.78 for turning 170 engines. Mr. William Michel, Engineer of Maintenance of Way of the Hocking Valley Railroad, states that the cost for fuel alone for operating a turntable equipped with a gasoline motor is seven mills per engine handled.

Mr. Michel also states that it costs his road 2½ cents per ton to elevate coal into the coal-bin by a 16-h. p. engine using natural gas. On one of the western roads coal is handled by engines of from 35 h. p. to 40 h. p., which are used to haul a car having a gross weight of 150,000 lbs. up a 20 per cent. grade at 20 ft. per minute. On this road the cost of handling the coal, including fuel, lubricating oil, and the attendance of an operator varies from two cents to four cents per ton, according to the size of the station and the wages paid the attendant. This is a decided improvement over the practice of a few years ago, when the cost of handling coal averaged about 20 cents per ton, and sometimes more. Similarly gas and gasoline engines have been used for hoisting sand or for pulling up cars of sand to discharge into the locomotives in the same way that coal is handled at coaling stations. They have been applied to swing bridges, and to rock-crushing plants. One western road uses a gas engine in a tie-treating plant, and for other purposes, in units up to pairs of engines of 100 h. p. each. One of the latest uses is that of operating a ballast-loader which is said to "permit the economic loading by power of material which will be required for ballast renewals where it would not pay to maintain a steam shovel." Men operating scoop shovels deliver the ballast at the bottom of a flight of conveyors, whence it is elevated and dumped into cars.

The use of gasoline engines on motor cars and inspection cars, is now quite well developed. Such cars really consist of a gasoline automobile running on railroad rails. They are much speedier, and if time has any value, are much more economical than human labor in propelling the car, tools and men. They are usually fitted with air-cooled motors, so that the water-jacketing of the cylinder, with its attending troubles and inconveniences and the necessity for transporting a tank of water are all eliminated. These cars seem to be giving the best satisfaction and it is stated that "one of them recently completed a bridge inspection trip of 1,500 miles, carrying four men and inspection tools, and made the trip on 45½ gal. of gasoline, making frequent stops to inspect bridges and culverts along the line, and attaining a speed of 25 miles an hour." This is a fuel consumption of three gallons of gasoline per 100 miles.

From an automobile running on city streets and country roads to a motor car on railroad tracks, carrying from 4 to 15 persons at a speed of 25 miles an hour or more, is apparently a very simple advance in the problem of transportation. Except from the point of view of economy of fuel, it is really questionable whether it is an advance, for the automobile, traveling a well-paved street or a flat steel track on a country road, has not a decided advantage in point of flexibility over the motor-driven car compelled to run on the rails. From a motor car to the passenger coach or freight car propelled by a gas engine using gasoline, petroleum oil or oil gas, or even a gas engine locomotive carrying its gas engines and gas producer, as has recently been suggested by a superintendent of motive power before the American Railway Master Mechanics' Association, is not beyond the range of possibilities. It is not generally known that among the 3,046 locomotives built in the locomotive works and railroad repair shops in 1900 are included five mine locomotives driven by gas engines, and valued at $5,000, as reported in Bulletin No. 243 of the 12th Census. It does not seem unreasonable to conceive of shorter trains requiring smaller power units operated by gas engines using crude petroleum, distillate or else oil or producer gas. Several solutions of this problem have been tried, and while they do not seem to be commercially successful as yet, the solution is without doubt possible. If there is room on an automobile 20 ft. long for an engine of 80 h. p. or 100 h. p. capable of propelling it over country roads at a rate of more than 50 miles an hour for several hours at a time, surely room ought to be found below the floor of a passenger coach for the 150-h. p. engines which will probably be required to meet the demands of interurban and express passenger service on steam railroads. The problem is difficult of solution for the reason that it demands intimate knowledge of the existing conditions on steam railroads, experience in gas-engine design and operation, considerable inventive ability and sufficient engineering initiative to do the thing required, irrespective of prejudice and opposition. It has been suggested that the best solution is to equip all of our steam railroads with electric traction for passenger and fast freight service. If this comes about the gas engine will be found to be the most economic prime-mover available for the generation of the electricity.

The most successful gasoline passenger car which so far has come to my attention seems to be the one designed by Mr. Robert McClelland, President and Manager of the Tabor & Northern Railroad Co. Mr. McClelland, writing from Tabor, Iowa, says: "We have had the gasoline passenger car in daily service on this line for the past two months. It carries 20 passengers, is 17 ft. long, weighs 6,500 lbs. and has a 25-h. p. gasoline engine. It maintains a speed on level track of 25 miles an hour and on a 3 per cent. grade it will make 10 miles an hour; one man runs the car and collects the fares. The cost of gasoline for regular service averages a trifle over two cents per mile. Our line is very hilly, so that on a level track the expense would probably be less. The engines are of the double 'opposed' type, working on one shaft, with cylinders 7 inch x 8 inch. The flywheel is 32 inches in diameter and is faced with sole leather over one entire side. At right angles to this wheel a friction wheel 22 in. in diameter receives the power from the large wheel and transmits it by a shaft to a gearing on the rear axle. The friction wheel moves on slides upon the shaft at the will of the operator from the center to the circumference of the large wheel; in this manner the speed is regulated. The car runs equally well either backward or forward, and the direction depends upon whichever side of the center of the large wheel the friction wheel is brought in contact with it. The operation of the car has been entirely satisfactory in carrying our passengers, and it is very popular. We are having a car built with a 100-h. p. engine, and arranged as a combination car for passenger, baggage, express, mail and local freight business. When we get this heavier car we expect to use our steam train only for car-load business. We are sure there will be great economy in this, as we can increase the frequency of our service, and yet effect a saving in fuel, labor and cost of maintenance of track and machinery. I will further state that our expense for repairs in the past two months has been merely nominal and the machine seems to be still in perfect order."

The last subject to be considered is the use of gas engines in railroad shops, and for central station work. In a paper read by Mr. Charles H. Williams before the National Electric Light Association at Cincinnati, Ohio, in May, 1902, on the "Advantages of Gas Engines for Central Station Work," it was shown that a "gas-engine-driven electric plant could profitably be installed as an adjunct to an illuminating gas plant, and that there is no doubt that gas engines of all sizes have reached a point where they can fairly rival the steam engine in reliability and good running qualities. In point of fuel economy the gas engine of medium size is on a par with the largest and most completely equipped triple expansion steam engines, since it will give a horsepower for each 1 to 1¼ lbs. of coal fed."

Some of the advantages of the gas engine for central stations are: Minimum fuel consumption; low cost of operation and maintenance; simplicity of equipment; only two auxiliaries required, namely, an air compressor for starting the engine and a magneto, or dynamo, for producing current for electric ignition; quick starting; no "standby" losses; the light load efficiency is superior to that of the steam engine; the waste heat of the jacket water and of the exhaust gases can be used for heating buildings; no danger from explosion; energy can be stored during light loads in one or more gas holders at less cost than by any other means; the greatest efficiency does not demand the use of the largest possible units, and hence the subdivision of the power among a number of smaller units gives better economy. For railroad work it is possible to erect either coal-gas or water-gas producers and to use the product in gas engines for the generating electricity, either at central stations or at different points around the shops and yards. The water gas could be carburetted for illuminating purposes, if desirable. The railroads might be able, in the light of recent experiments and experiences, to convince the managers of city gas-light works that it was to their interest to increase the amount of coal gasified in their present works so as to furnish more gas for use in gas engines by the railroad company and at a rate which would make the net cost of power when so generated much less than with steam power. It may be argued, however, with good reason that a railroad company should be independent of any private or municipal gas-light company for its source of energy.

The same argument is equally good when applied to the generation of electrical and mechanical power by gas engines supplied with blast furnace gases from blast furnaces located contiguous to the railroad. The waste of heat energy in our blast furnaces can be illustrated by the statement that approximately 125,000 cu. ft. of gas having a calorific value of from 100 to 130 B. T. U. are delivered by the furnace per ton of pig iron made per hour. Of this gas, 35,000 cu. ft. will probably be required for the stoves used in heating the blast supplied to the furnace. The remaining 90,000 cu. ft. of gas at ordinary temperatures and at about atmospheric pressure will carry from 9,000,000 to 11,700,000 B. T. U. of latent heat energy. As it requires from 8,000 to 12,000 B. T. U. to generate a brake horsepower for an hour, or an average of 10,000 B. T. U. per brake horse-power-hour, this amount of energy is capable of delivering from 900 to 1,170 brake horsepower per ton of iron made per hour. Of this amount of power, from 200 to 250 brake horsepower will be required per ton of iron made per hour to run the blowing engines, pumps, lighting and other machinery forming necessary parts of the blast furnace plant. This will have a net balance of from 650 to 910 brake horsepower to sell for each ton of iron made per hour. The above are conservative figures

and not extreme in any particular. As the average rate of production of pig iron in the United States is now about 2,200 tons per hour, this means that from 1,430,000 to 2,002,000 brake horsepower, the majority of which is quite easily available for use, is now being wasted in this country alone. As most railroad companies do not operate blast furnaces, it may be argued that this is not a possibility for them; but it can be replied that many of the railroads could obtain the supply if, in creating the demand, they were willing to offer the blast furnace manager a suitable financial inducement. For those roads of New York, Pennsylvania and Ohio which are affiliated with companies making pig iron, the problem of using these waste gases in gas engines for the generation of electricity for use on electric railroads is one whose solution has been demonstrated many times abroad and by the plant of the Lackawanna Steel Company, near Buffalo, where 40,000 horsepower of blast-furnace-gas, gas engines are being installed, several thousand horsepower of which are now in use. It would seem probable that if the steam railroads will not take advantage of this available source of wasted power, that the electric railroads will buy and use as much as they may need.

Another similar source of power is coke-oven gas, which is open to the same objection which has been raised to coal-gas, water-gas and blast-furnace-gas, unless the railroad company has use for, or a market for, the coke and by-products from the coke-ovens.

The remaining source of gaseous energy yet to be considered is that of producer gas. This offers the greatest possibilities in the field of power for use in railroad shops and for the generation of electricity. Gas producers work with efficiencies of about 80 per cent., are simple in construction and installation, are comparatively cheap and can be effectively operated by comparatively unskilled labor. Assuming a calorific value for 1 lb. of ordinary coal of 13,000 B. T. U., and a thermal efficiency for the gas producer of 80 per cent., it should deliver 10,400 B. T. U. to the gas engine per pound of coal gasified. As a number of gas engines have developed a brake horsepower for the combustion of gas containing from 8,000 to 10,000 B. T. U., it is apparent that a brake horsepower can be easily developed for less than one pound of ordinary coal.

If power alone is desired, ordinary producer gas, made by the injection of air by a steam blast into the bottom of a producer in a continuous gas-making process, will give satisfactory results. The producer plant of the Erie Railroad yards in Jersey City, which has been in operation for over four years, supplies gas engines of 400 nominal horsepower which are said to average 200 horsepower delivered. In 24 hours three tons of buckwheat anthracite coal are used at a cost of 65 cents per ton. On this assumption, the cost of fuel is .4 of a mill per horsepower hour. The manufacturers guaranteed to generate 80 cu. ft. of gas containing 125 B. T. U., or a total of 10,000 B. T. U. for each pound of anthracite buckwheat or pea coal, and further that the engines should develop a horsepower on 1¼ lbs. of coal. Using a low grade of rice coal, 86 cu. ft. of gas, having an average calorific value of 140 B. T. U. per cu. ft., or a total of 12,000 B. T. U., per pound of coal was obtained. The gas engines delivered a horsepower for the gasification of 1.03 lbs of coal. While this was a most excellent result at that time, it is thought that better results can be obtained to-day. The first-cost of such producers is from $18.50 per horsepower in 800-h. p. units to $22 per horspower in 350-h. p. units. With smaller sizes, such as 75-h. p. units, the first cost may go up to $50 or $60 per horsepower. Their shipping weight varies from 700 lbs. per horsepower for the smallest to 300 lbs. for those of 300 h. p. and over.

For producers of small size, say from 100 h. p. down to 15 h. p., Taylor gas producers are too expensive in first-cost. For such units, suction gas producers are being introduced. The principle is the same, but once the producer has been started by the aid of a suction fan, and the engine has been started by compressed air, or other means, the engine sucks its charge of gas from the producer. No gas holders are needed, and the plants are said to be as automatic and as satisfactory to operate as an ordinary "base-burner" stove, the difference in practice being that the engine acts as a chimney to create the draft, and the fuel is burned to carbon monoxide in the producer, and it in turn is burned to carbon dioxide in the gas engine. Suction gas producers are now made in units of from 10 h. p. to 200 h. p. In France they are used in large numbers for supplying gaseous fuel to gas engines driving small shops and factories and where the cost of fuel is such that a steam plant is not to be considered. They require only general oversight and occasional attention. Unfortunately, they use anthracite coal or coke, and do not work so well with bituminous coal. However, if the price of gasoline continues to advance, users of small gasoline engines for pumping stations, or for operating turntables and the like, may be forced to use them for reasons of economy.

When gaseous fuels are needed, not only for power purposes, but also for metallurgical purposes, such as the heating of steel billets and blooms, for forge fires, for tempering, annealing and galvanizing, either a combined water-gas and producer-gas process, or a water-gas process, or an oil-gas process should be used. Producer gas alone does not make a sufficiently intense heat for blacksmith shop work. The experience of the gun shop of the Washington Navy Yard, as given in the testimony of Admiral O'Neil, is that the use of oil-gas costing from 8 to 12 cents per 1,000 cu. ft. is most satisfactory in furnaces and forges of all sizes. This gas can also be used in gas engines for the generation of power, at the rate of 30 cu. ft. per brake horsepower per hour, so that in railroad repair shops a plant of this kind will supply both demands. For large amounts of metallurgical and power work, the combined water and producer-gas gas-plant seems to meet the requirements. The cost of the gas, as determined by a test, and including all factors and fixed charges, has been shown to be 3.22 cents per 1,000 cu. ft. of gas having a calorific value of 135 B. T. U. per cu. ft. Assuming a consumption of 80 cu. ft., or 10,800 B. T. U., per horsepower, the fuel for the gas engine will cost 0.27 cent per brake horse-power-hour. I would recommend the use of producer-gas for railroads for power purposes, and of either one of the combined water-gas and producer-gas processes, or oil-gas, for shops where gas is needed for metallurgical uses as well as for power purposes.

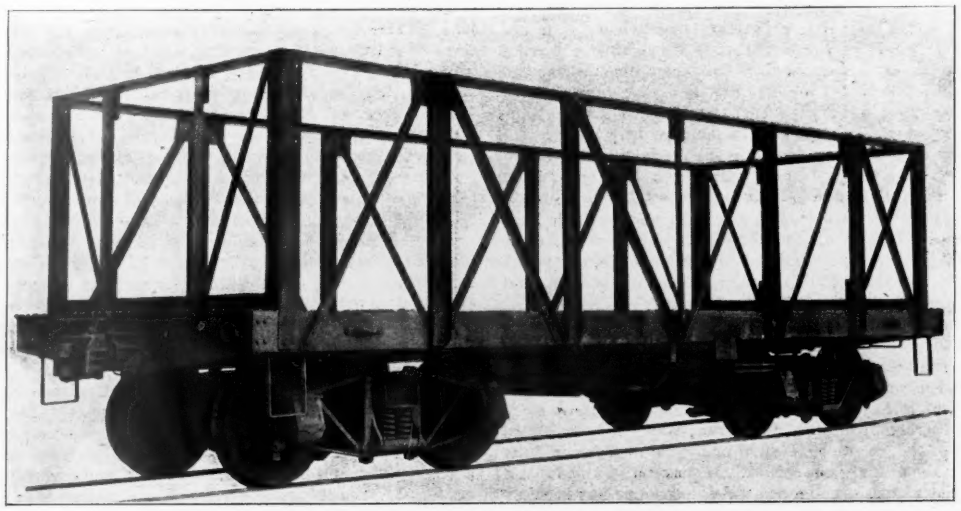
The gas engine is a source of motive power which must hereafter be reckoned with; and as the price of coal increases, the gas-engine plant has just so much more advantage over the steam plant in cost of operation. The old arguments of unreliability and difficulty in starting are no longer tenable. With good engines, such as are now obtainable at a fair price, unreliability shows either the lack of sufficient knowledge and skill on the part of the engineer, or the want of proper and sufficient attention. Difficulty in starting an engine provided with a reservoir of compressed air, in most cases, demonstrates the ignorance of the operator. Gas engines have been operated for several hundred hours consecutively without stopping, and the fact that they are so seldom provided with duplicates, as is the practice in steam plants, is good evidence of their reliability. As to their speed of starting, I recently saw one engineer start a 1,000-h. p. twin Koerting gas engine using blast-furnace gas at the Lackawanna Steel Company's plant at West Seneca, near Buffalo. It took him 45 seconds to open or adjust the lubricators. The gas valve at the main being open, from the time he opened the compressed air valve until the engine was working under gas power was 25 seconds by the watch, and only 15 seconds additional were required to get it up to full speed without load, or a total of one minute and a half from the time the order was given until the engine was running at full speed. If the opening of the lubricators had been deferred until after the engine had been started, less than three-quarters of a minute would have been required to get the engine started and up to full speed.

The objection to gas engines which are now current is their weight, first-cost, and the floor-space required. With the use of better materials and a better understanding of the forces introduced in a gas engine, and with the more general adoption of the multiple-cylinder, vertical engine, the floor-space will be diminished, and the weight, including flywheels for an engine suitable for operating direct-connected alternators in parallel, will be reduced to from 250 lbs. to 270 lbs. of net weight per rated brake horsepower; and to from 180 lbs. to 200 lbs. of net weight per brake horsepower without the flywheels. The prices of small gas engines vary greatly. The most costly engine to buy is probably the Diesel, as its first cost is about $70 per brake horsepower for the smaller sizes, and $65 for those of 200 brake horsepower and upwards. The saving effected in the cost of the oil fuel which it uses is a dividend-paying asset to balance the difference in the first-costs. The selling price of gas engines of from 500 to 3,000 brake horsepower is about $50 per horsepower. While these prices are much higher than those of most steam engines, the first-cost of the engine is not the only item of expense in the generation of power.

Until someone shall invent and be able to successfully generate electricity directly from coal, and with an efficiency at the switchboard of over 70 per cent., the gas engine must be reckoned with seriously as a prime-mover. While it is not thought that it will entirely dispossess the steam engine and steam boiler for the generation of power in all lines of industry, equal reliability and a very much greater economy are claimed for the gas engine and gas producer, and these claims are proved by the rapidly-increasing number of both small and large gas-power plants which are being installed.

40-Ton Coal Car with Steel Underframe.

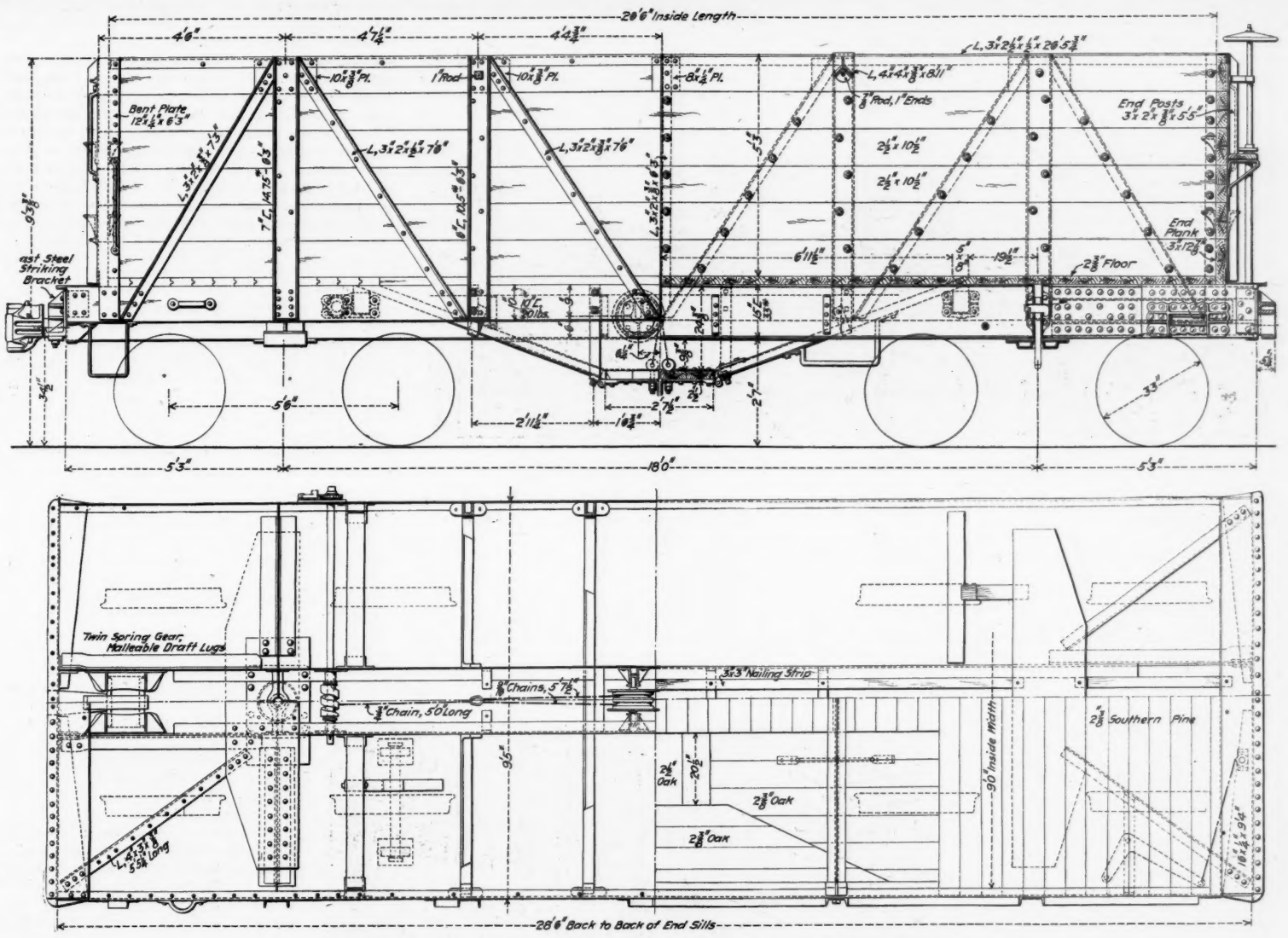
The Middletown Car Works has recently completed a number of coal cars of interesting design for the Berwind-White Coal Mining Company. They were built on the buyers' specification that a body with a cubic capacity equivalent to a 40-ton load, be mounted on Pennsylvania standard 50-ton trucks. It is expected that this reduction of wheel load from that for which the trucks were designed will result in a decrease in the cost of wheel replacements which on some of the mountainous roads in Pennsylvania has assumed rather alarming proportions. The cars are generally similar to the P. R. R., class Gn, wooden hopper gondolas with the exception of the steel truss side frame and structural steel underframe. The experience of the Norfolk & Western with a composite wood and steel construction has been very satisfactory and it would seem that in many respects cars of this design are better adapted to coal traffic than the all-steel car, especially when the coal carried is high in sulphur with a resulting serious corrosion of the steel plates in the sides and floor of the car. When loaded cars are standing in yards or sidings exposed to rain or snow, the water percolating through the coal combines with the impurities, chiefly sulphur, and forms a weak acid which attacks the plates and framing of the cars and soon renders them unfit for service. No altogether satisfactory method of painting the inside of steel cars has yet been found which will protect the plates from the action of these acids and for this reason the cars with wooden floors and sides and steel frame will probably show a longer period of service than the all-steel cars, at least until some perfect anti-corrosion paint is found. The great advantage of the steel car is the saving in repairs. In the case of wrecks or minor damage the plates and members of the underframe of the steel car can usually be heated and straightened at a small cost and this process repeated an almost indefinite number of times, while in the case of the car with a wooden body, the planks, as a rule, are badly splintered and must be entirely replaced at a considerable cost. However, a car with a stiff steel underframe and trussed sides and ends is not so liable to severe damage as an all-wood car.



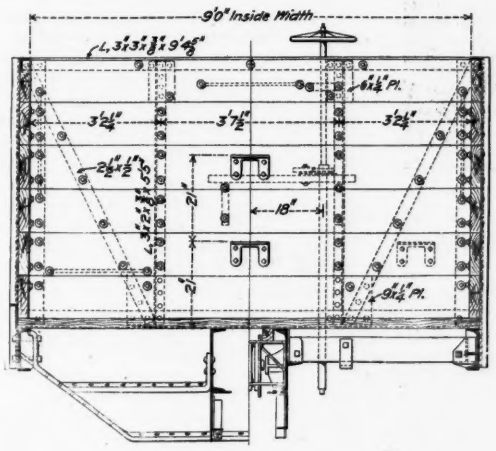
Framing for 40-Ton Steel Frame Coal Car.

The drawings and accompanying photographs of the skeleton framing show the construction of these cars very clearly. The center sills are 15-in., 33-lb. channels, and the side sills are 10-in., 20-lb channels. The draft sills are 14½ in. x ⅜ in. x 3 ft. 10 in. plates butt spliced to the center-sill channels with two angles and a plate 5¾ in. wide riveted on the outside faces with 28 rivets on each side of the joint. This gives a stiff and substantial splice which construction is even better than continuous center and draft sills, inasmuch as a great majority of the failures due to exceptional shocks occur in the ends of the car between the end sill and the bolster, and if repairs have to be made it is much quicker and cheaper to cut out and replace a short section of draft sill than to cut out an entire center sill, straighten it and then repair it. Splices are used largely in repair work on continuous sills with good results and there is every reason why they should be used on new work. Unlike the Norfolk & Western design, these cars have a steel end sill made of a bent plate ¼ in. thick instead of a wooden end sill, as in that design. The opening for the coupler is re-enforced with a heavy cast-steel striking bracket.

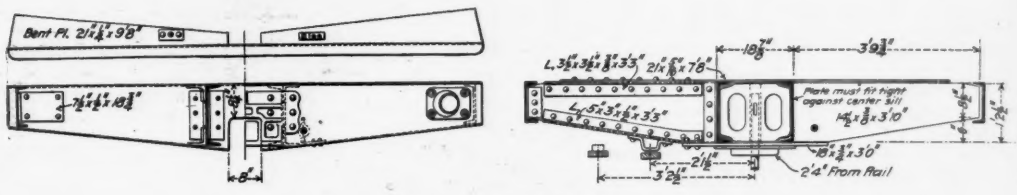
The car-body is 26 ft. 6 in. long, 5 ft. 3 in. high and 9 ft .wide, inside. Three-inch planks are used in the ends, 2½-in. planks in the sides, and 2⅜-in. oak planks in the floor and hopper. The side frame is made up of four channel posts and an angle post with angles for the diagonal braces and top chord. These are riveted to the outside face of the side sill at the bottom and to gusset plates at the top. The corner plates are bent plates ¼ in. thick, riveted to the side sill and to the end-sill cover plate. The side and end planks are bolted to the truss frame with ½-in. carriage bolts. The hopper doors are operated with a double chain running over a sheave placed between the center sills directly over the center of the hopper. Three chains are joined with an eye link to a single chain which is wound on a worm on the winding



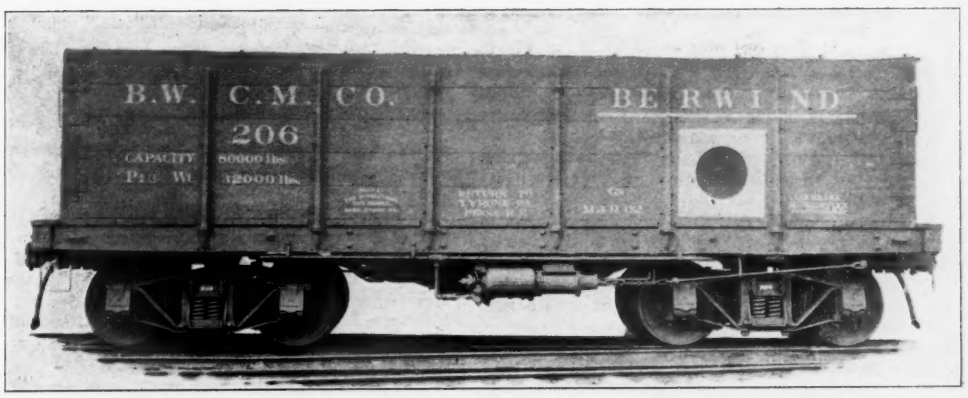
Plan and Elevation of 40-Ton Steel Underframe Coal Car—Built by the Middletown Car Works.



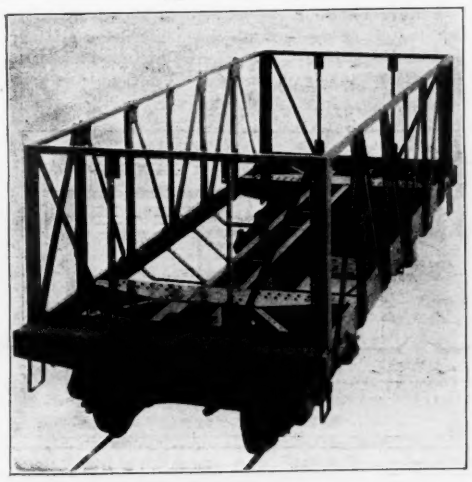
Cross-Section of 40-Ton Coal Car.



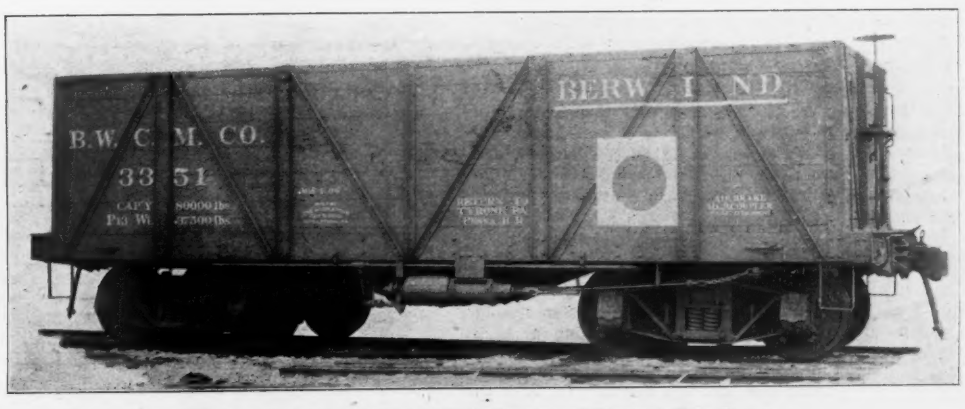
Details of End Sill and Bolster.



40-Ton Coal Car with Wooden Underframe and Pressed Steel Side Stakes.



Skeleton Framing.

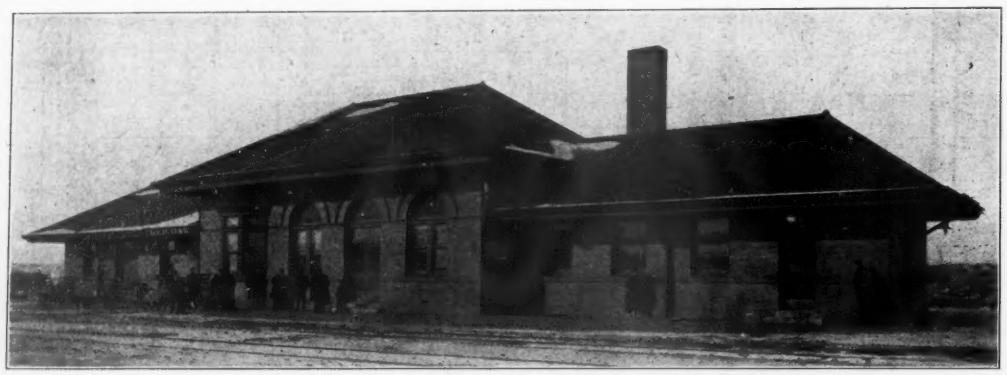


40-Ton Coal Car with Steel Underframe and Trussed Side Frame.

shaft placed just back of the bolster and running through to one side of the car only.

The light weight of this design of car, mounted on 50-ton trucks, is 37,500 lbs., as against 32,000 lbs. for the all-wood car of the same class. If 40-ton trucks were substituted, the weight would be reduced about 1,500 lbs., which would bring the light weight down to 36,000 lbs., not an excessive figure.

We are indebted to Mr. George I. King, Vice-President and General Manager of the Middletown Car Works, for the illustration and description.



Red Oak Passenger Station, C., B. & Q. R. R.

New Burlington Station at Red Oak.

Red Oak, Iowa, is a prosperous and thriving little city of over 6,000 inhabitants situated in the heart of a rich farming country. The extensive work that the Chicago, Burlington & Quincy is doing on its Chicago-Omaha line in double-tracking and changing line and grade, involved some considerable changes at this point. The new line of road was carried through the town about three blocks south of the old, and is about 35 ft. higher to overcome the heavy grade that has heretofore existed on each side of Red Oak. In connection with these improvements a new passenger station has been built to supersede the old frame structure which was built in 1871. The new station is three blocks east of the old one and, being on the new line, is also three blocks south. The ground selected was originally side hill, which was graded down suitable for a good foundation. The location affords a fine view of the beautiful little city. The station is one of the neatest and most convenient in its accommodations of any of the small-city stations on the line, and is an attractive example of this class of stations in general.

The building is pressed brick on stone foundations. There is a layer of terra cotta under the window-frame line around the entire building. The roof is slate. On the interior the main waiting room floors are maple, the walls are plastered above a wainscot of paneled oak and the ceilings are paneled. The women's waiting room, the lunch room, smoking room, ticket office, lobby and corridors are similarly finished except that the ceilings are plastered and the oak wainscot is V-jointed. The baggage and express rooms have pine wainscot, whitewashed walls and plastered ceilings. There is a basement under the east end for a boiler room and steam-heating plant. The building is equipped with a first-class water service, has gas and electric lights, and there are four arc lights outside.

There are neat brick platforms and wing-walks with concrete curbing. The city of Red Oak extended the street paving to the new station and the railroad company in connection with this work made two separate driveways to the streets and sodded the space between with a rich, specially selected sod. A paved foot-walk was also put in. The cost of the station complete, which was opened on December 29, 1903, was $17,847. A three-story brick hotel is being put up across the street from the station.

We are indebted to Mr. W. F. Hayes, Superintendent of Bridges and Buildings, Creston, Iowa, for drawings, photographs and information courteously supplied.

Waiting Room, Red Oak Station.

Foreign Railroad Notes.

The ingenious track watchman who thought to win reputation and promotion by laying a rail across the track in front of an express train near Offenbach, and then signaling the train with a lantern has had an interview with a criminal court, which sent him to prison for a year.

"The best laid schemes of mice and men
Gang aft a-gley."

The German Dining Car Co. report for the year ending with September last, the seventh of its existence, that it had 39 dining-cars and conducted the dining-car business on certain lines which owned their own cars. Its gross receipts for meals and drinks were about $287,000, and its net earnings $97,380; $41,811 was charged off for depreciation, and there was enough left for a dividend of 10 per cent., the capital of the company being only $476,000.

A Russian factory is building hospital cars for the Chinese Eastern Railroad. Each has compartments for the surgeon and the hospital steward, disinfecting apparatus, an operating room with the requisite appliances, and in the main compartment eight beds for patients. Ten such have been delivered and 50 more are ordered. There is to be one for every 100 versts (66 miles) of road. All these orders were previous to the trouble with Japan.

The Austrian Minister of Railroads, submitting his estimates for 1904, places the receipts of the State Railroads $223,000 greater than for 1903; and the expenditure $1,112,000 greater. More than $300,000 of the increase in expenses is required for pensions and other matters for the benefit of the employees. The increases in wages, etc., are nearly balanced by reduced cost of materials. The net receipts are estimated to be about 2¼ per cent. on the capital invested.

A Study of the Interstate Commerce Commission Accident and Safety-Appliance Reports.

At the January meeting of the Car Foremen's Association of Chicago, a committee consisting of Messrs. C. D. Petters, Chairman; H. LaRue, G. M. Bates and B. Guthenberg submitted an elaborate report based on the Accident Reports contained in the 16th annual report of the Interstate Commerce Commission. This committee report will be discussed at the February meeting of the Association, to be held Wednesday, the 10th inst. Referring to the results that have been accomplished since the Safety Appliance Act has been in effect the report says:

During the period from the enactment of this law up to and including the year ending June 30, 1902, very satisfactory and encouraging results were accomplished. Compared with 1893, the year ending June 30, 1902, shows a decrease of 68 per cent. in the number killed in coupling and uncoupling cars, and 81 per cent. decrease in the number injured. This in the face of 37 per cent. increase in the number of employees engaged in such work, and 44.5 per cent. increase in the number of cars. The amount of work done is also an important factor; in the time mentioned the increase was 52.7 per cent. increase in the average number of tons handled in each train and 57 per cent. increase in the tons handled one mile. As representing in a measure the condition of car equipment in its relation to safety, the following comparative figures are impressive:

	1893.	1902.
The number of cars for each fatality...	2,340	10,240
The number of cars for each injury.....	90	693

It would naturally be expected that the conditions of 1902 must show marked improvement over 1893. However, gratifying decreases are found in the year 1901-1902, compared with 1900-1901, 27.78 per cent. being the decrease in number killed while coupling and uncoupling cars, and 23.67 per cent. in the number injured. In 1893, 16 per cent. of all fatalities were chargeable to coupling and uncoupling cars, and 35.5 per cent. of the injured. As late as 1900 this was 11 per cent. for all employees killed and 13 per cent. for the injured. In 1902 5.6 per cent. represents the number killed, and but 6 per cent. the number injured.

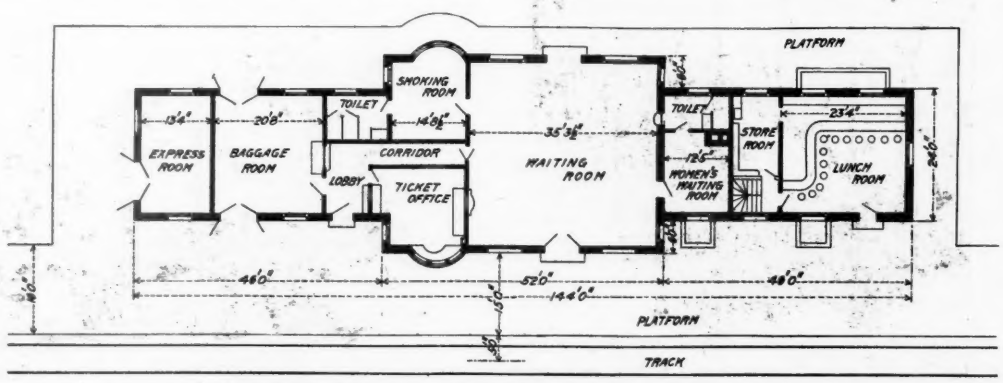
Although considerable satisfaction may be derived from the foregoing figures, the reports for the year ending June 30, 1903, compared with the preceding year, are not so gratifying. The number killed while coupling and uncoupling cars increased 77 per cent., and the number injured 32 per cent. The commission assigns three causes for this increase: The enormous increase in the volume of business handled, the fact of all accidents now being reported, and the employment of inexperienced men. The last is due to the demand being in excess of the supply.

It is to be regretted that figures are not available showing the increase in work done and in number of cars, so that a more thorough comparison could be obtained. The increase in number of employees is reported as 12 per cent.

The Safety Appliance Act involves four fundamental considerations: Train Brakes, Automatic Couplers, Grab-Irons and Hand-Holds and Standard Height of Draw-Bars for Freight Cars. For the benefit of detailed investigation, subdivisions have been made of each general subject, outlining the main features related to each.

Train Brakes.—All new cars built, and a large percentage of the old ones, are equipped with air-brakes. In fact, some lines are equipping all their cars. This state must ultimately exist, as all new cars are equipped, and the old ones are rapidly going out of existence. One inspector reported "it is not an uncommon occurrence to see a 70-car train, all air and all working." The expression of all the inspectors is that the general conditions show great improvement. However, when it is considered that 42.6 per cent. of all the defects reported for the year 1901-1902 were found in the air-brake apparatus, amounting to 19,011, it will be seen that the opportunities for further improvement are still very great. Of this number 34 per cent. were cases of air-brakes cut out with no card applied, 33 per cent. cylinders and triple valves not cleaned in 12 months, and 15 per cent. cars with no dates shown on cylinders or triple valves. The General Inspector states that an examination of the reports showing the number of air-brake cars in use per train indicates that perhaps one-third of the air-brake apparatus is not used; these conditions being more pronounced east of the Mississippi River. The reasons for this large percentage are not stated, but it is inferred the principal cause is failure to switch air-brake cars together, as nothing like the percentage given could be defective. The inspection reports do not state what percentage of the 161,371 cars inspected were equipped with air-brakes, otherwise the percentage with brakes in bad order could be determined.

Failure to apply air-brake defect cards when cutting out the air is a practice occasioning delay and expense, besides being dangerous. The Chief Inspector states that the use of the card has not become satisfactorily uni-



Plan of Red Oak Station, Chicago, Burlington & Quincy.

form, and the other inspectors complain that cards are not used, and "trouble comes from cars cut out and not carded." Trainmen, although almost entirely responsible for this defect, cannot safely cut in the air; furthermore, car repairers, in many instances, cannot locate the defects without thorough inspection and test, which is not always possible. Some companies use a card having a small eye in one end with a wire fastened through it, to be secured to branch pipe or cut-out cock. This has advantages over the regulation card in that it can be more easily applied; avoiding the necessity for obtaining tacks and something to drive them with, and can be more readily discovered by repairmen than when examining sides of car amongst shipping cards, bad order cards, etc. Positive instructions should be issued requiring the use of the card in all cases when air is cut out.

In the matter of cleaning cylinders and triple valves, the inspectors report remarkable progress. It is claimed by some of the inspectors that in some instances triple valves are taken down and cleaned under the cars, then reapplied. This is unreliable, and should not be permitted. The only satisfactory method is to remove the triple and apply another which is in good order, the valve removed to be given attention for use when ready. Particular attention is directed to the greater necessity for more testing and charging plants in terminal yards.

The 15 per cent. of defects under the head of cars with no dates stenciled showing when brake apparatus last received attention, is a condition which, while of itself easily overcome, indicates that either the work was not done, or the marking omitted; probably the former. The inspectors report cases of dates chalked. This is bad practice, and should not be tolerated. Stencils are easily and cheaply obtained, and the time necessary to stencil the dates insignificant.

The question of train-pipe leakage presents a feature of more significance than possibly is accredited it. Considering the dangers attending excessive leakage, too much emphasis cannot be placed on the necessity for maintaining tight pipes and joints at all times. Defective hose is responsible for much of this, and the defective hose is due to the common practice of not separating the air-hose when separating cars.

Maintenance of proper piston travel forms another subject which merits more attention. Inspection of air-brakes and allied parts may evidence good condition, yet wear of shoes, excessive motion of levers, connections, pins and looseness of cylinder blocks, separately insignificant and not easily detected in the aggregate occasion too much piston travel with attendant loss of braking power and injury to the equipment. This question relates directly to the advantages of terminal testing plants, as such defects can only be determined by applying the air. Little time is afforded repairers to correct such conditions after engine has been coupled to train: in nearly all cases it is impracticable.

Some of the Interstate inspectors advocate the use of a slack adjuster. The committee acknowledges the desirability of a slack adjuster, if it will do the work, but in the experience of its members such a one is not known. The various types, as far as known, will take up the slack from worn shoes, etc., but when new shoes are applied, possibly in haste, the movement is too small until the adjuster is adjusted. The device should automatically take care of the slack and also adjust itself in the application of new parts.

Automatic Couplers.—This general consideration presents a many-sided proposition with unending variations. The diversity of designs occasions a diversity of material, rendering the maintenance of parts both difficult and expensive. The complaints by the inspectors of improper repairs by reason of inability of outlying, and even principal points, to obtain sufficient and suitable material, is due to this unlimited variety, as well as the difficulty in procuring material. Greatly increased business and activity in construction during the past few years, and consequent inability of the manufacturers to supply the demand, has occasioned this. The lack of standards is deplorable, and is a state of affairs which could be overcome. The committee feels that something can be done in this direction, and advocates the selection and general use of such standard types as may be demonstrated by thorough examination, test and long service, to be the best suited to fill the requirements.

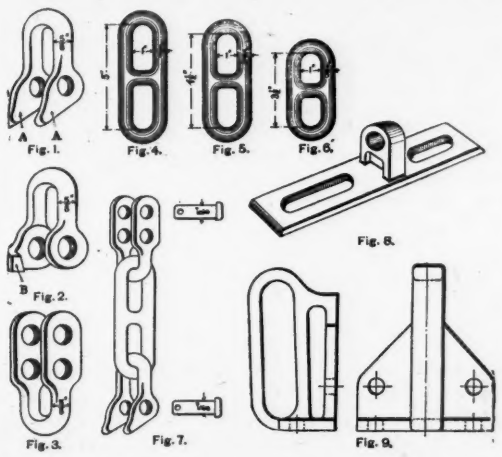
The coupler with lock-set within the head is a generally recognized necessity, and is now required. This dispenses with the variety of uncoupling rod brackets for lock-set purposes, and which are largely responsible for defective uncoupling attachments. Another point in the general consideration of couplers is the knuckle-opening feature. The great danger attending the necessity for going between the rails to open the knuckle by hand, in many cases while cars are in motion, is undoubtedly the source of many fatalities and personal injuries. The Interstate inspectors recommend the knuckle-opening coupler, and the committee concurs, believing the question to be one of importance.

The uncoupling attachments are found to cause great trouble, 22,601 defects being reported for the year 1901-1902 on this account, and from 20 to 30 per cent. of all accidents, due to uncoupling rods and attachments. The rod itself, usually of 1-in. round iron, is considered generally satisfactory. The use of rods extending entirely across end of car has been advocated. Your committee does not consider this necessary nor advisable.

Uncoupling chains, clevises and pins are the keynote to the maintenance of uncoupling attachments in good order. There must be an absolute discontinuance of S hooks, lap rings and links. The ease with which these become open and lost at once condemns them. But one solution remains, and that is the use of solid links and clevises with pins and cotters. The details of these have been carefully investigated, and many varieties examined. After careful consideration the committee decided the best arrangement was a bottom clevis of the design shown in Fig. 1, made from malleable iron, and with projecting ears, A, to throw the chain outward when released, preventing it from getting between horn of coupler and deadwood and becoming damaged. The design of some couplers preclude the use of the clevis, necessitating a design such as shown in Fig. 2, the lug, B, accomplishing the same purpose as the ears, A, in Fig. 1. For the top clevis a design is recommended as shown in Fig. 3, which has an additional hole to permit adjustment of the length of chain without substituting other parts.

The connecting links should be malleable iron 5/8 in., round size, solid, connected at center to prevent breaking, and of varying lengths to accommodate the differences in total length required. Two or three lengths will be found sufficient, as shown in Figs. 4, 5 and 6. Fig. 7 illustrates the chain complete.

The uncoupling-rod brackets are of but slightly less importance than the chains, and must be in good order and adapted to the coupler to produce results. The extensive use of lag screws is largely responsible for defects reported. It is almost unnecessary to state that, they should not be used. They hold the brackets but indifferently, and for a limited time only; then become loose, finally work out and are lost. Bolts alone can be relied upon, for satisfactory length of service. Although the conditions are sometimes adverse, a number of methods can be employed to overcome them. The center bracket is sometimes difficult to secure with bolts, but this can usually be done. Several designs are in use, one in particular being considered suitable in that it will accommodate certain variations in centers of middle bolts through the deadwood. This type is illustrated in Fig. 8, attention being called to the elongated holes to suit the varying bolt centers.



Attention is also called to a type of bracket frequently used, having the hole for the uncoupling rod elongated to increase the range of movement of the uncoupling rod, and also the movement of the coupler in trains, preventing the uncoupled chain from becoming too tight and breaking, or unlocking the knuckle and causing break-in-twos. One form is shown in Fig. 9.

The outer bracket should also be bolted to the car. Couplers without a lock-set within the head require a lock-set bracket. The difficulty experienced in maintaining the proper adjustment is a convincing argument in favor of the lock-set coupler. The use of the lock-set coupler will enable the use of a plain bracket, which will be more generally satisfactory.

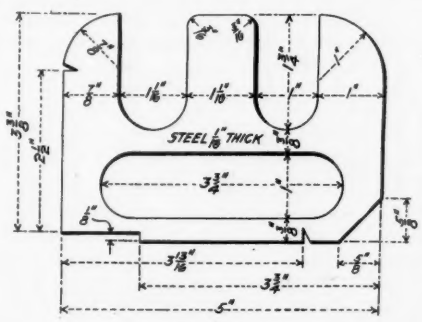


Fig. 10.

The Interstate inspectors and Chief Inspector are unanimous in recommending the solid knuckle, with the information that it is gradually coming into use.

The M. C. B. Association has modified the standard contour to afford greater strength at the knuckle pin, as well as to produce the hook form which has a tendency to make the couplers wear together, instead of apart. This has been approved, and should be put into use, as more satisfactory conditions will undoubtedly result.

The long knuckle pin, used to some extent and embodied in the recommended practice of the Association, is considered by the committee as possessing advantages in that broken pins with lower part missing can more readily be detected.

In the inspectors' reports reference is made to the disadvantages arising from the inability of inspectors to properly gage worn couplers, a more simple gage being required for quick inspection than the M. C. B. gage, for this purpose. Investigation developed the fact that as a matter of daily routine at inspection points the M. C. B. gage was rarely, if ever used, it being confined more exclusively to shops, where more thorough examination is possible. Such efforts as are made involve measuring the fundamental dimensions with a rule or using a short piece of iron cut to the requisite length or notched. The committee gave this careful consideration, realizing that closer inspection for worn couplers meant less break-in-twos, damage to equipment and better service. It was found that the wheel defect gage, as approved at the last M. C. B. Convention, and required in the Rules, could readily be adapted to this purpose, with but slight modification, and in no way altering any of the features required as a wheel gage. The essential dimensions for quick inspection to determine if couplers are safe for service, are: The distance from pulling face of knuckle to body of coupler, 3 13/16 in., and the distance from guard arm to knuckle, 5 in. The wheel defect gage is now 4 7/8 in. long and the addition of 1/8 in. to the total length to obtain the 5 in. is added to the middle section, making it 1 1/16 in., instead of 13/16 in. To show the 3 13/16 in. dimension, a small notch is cut on the bottom edge, the same as one on side edge for gaging flat spots, thus producing a combination gage, fulfilling the functions of wheel gage and also enabling coupler inspection for ordinary purposes. The modified gage, as recommended by the committee, is shown in Fig. 10.

Grab-Irons and Hand-Holds.—A generally satisfactory state is reported to exist; 6.98 per cent. of the total number of cars found defective are in this class, the principal defects being hand-holds missing and bent. There are, no doubt, but few cars found not properly equipped, and the defects reported are largely due to end ladders damaged by long loads. There is some controversy as to the relative value of end ladders and side ladders; some favoring those applied to ends of cars, and others the side ladders. The committee's opinion is that the side ladder presents the most satisfactory practice as a matter of safety and general service conditions. As for the hand-holds on roof, complaint is made of liability to injury by reason of trainmen being made to determine, in the dark, whether car has side or end ladders. In the use of side ladders the roof grab should be placed lengthwise of car, and located in the same transverse line as the side ladder. If end ladders are used, the committee recommends that roof grab be placed diagonally at corner, about 15 in. from end; thus serving as foot hold, as well as grab handle.

The matter of steps justifies great care. They should in all cases be bolted and kept in first-class condition. A step iron should be applied at end of cars, on the same side as uncoupling rod, and immediately under the end grab. This enables a safer position for trainmen, when for any reason it is necessary to ride on end of car. Some roads now follow this practice.

Standard Height of Draw-Bars for Freight Cars.—Generally satisfactory conditions are reported by the Interstate inspectors, also by the committee. This is simply a service condition which requires its share of attention. Only 213 cases of improper height were found in 161,371 cars inspected.

In conclusion, the committee directs attention to several points involved in the general proposition of safety appliances and their maintenance. One of these is that of reports. The Interstate Commerce Commission has established a certain classification of defects which is intended to cover all defects found by inspectors as influencing safety. This information is of great benefit in determining the parts productive of the largest number of defects, thus calling for greater care and attention in those particulars. For instance, in uncoupling mechanism, 11,191 cases of defective chains, clevises and clevis pins were reported, and as this is about one-half of all defects in this class, renewed efforts are necessary in maintenance, to prevent such a large number.

The classified table for the year ending June 30, 1902, shows a classification of defects, and the committee recommends that this same classification be used more extensively in recording defects. But two roads seem to be making such records, the C., B. & Q. and N. C. & St. L.

Chief Inspector Groobey states: "It is evident that many of the railroads could with advantage devote more time and care to the proper investigation of defects of couplers."

Attention is called to a condition sometimes met with in connection with inspection made by the Interstate Commerce Commission Inspectors in that they do not acquaint the officer in charge of the mechanical work of such yard, and who is more familiar with the general operating practice than car inspectors or yard employees, that such inspection is to be made. It thus happens that cars are examined and reported defective which are to receive attention and be made serviceable before put into trains, although not carrying bad order cards. Whereas, if examined when about to be switched for movement would be found in good order.

Your committee does not agree with the statement set forth in one of the Inspectors' reports that the adoption of the automatic coupler is not responsible for damage to equipment. While it is a fact couplers in many instances require considerable impact to couple, the fact undoubtedly remains that the automatic feature is productive of less care in switching. The M. C. B. Association recognizes the fact of this rough handling by setting forth certain combinations of defects which indicate this.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The startling increases in operating expenses of the leading eastern railroads were pointed out in the summary of annual reports printed in the *Railroad Gazette*, Jan. 8. The preliminary returns just issued by the Pennsylvania for the year ending Dec. 31, furnish an extreme example of this tendency. The directly operated lines of the Pennsylvania Railroad east of Pittsburg show an increase of $9,963,100 in gross earnings over the year previous and an increase of $9,722,000 in operating expenses, leaving a slight increase in net, 2.4 per cent. of the gross increase. But all the other four main operating divisions show increases in expenses exceeding the increases in earnings, leaving net receipts less than in 1903. With gross earnings for 1903 greater by $1,253,000 than they were in 1902, net earnings on the Philadelphia, Baltimore & Washington decreased $129,500. On the Northern Central, gross earnings increased $1,853,400 and net earnings decreased $15,400; on the West Jersey & Seashore the increase in gross amounted to $366,700 and the decrease in net to $56,900. Gross earnings on the lines directly operated west of Pittsburg and Erie increased $5,193,600, but net earnings decreased $397,800. Taking the aggregate of the five divisions it will be seen that gross earnings show the remarkable increase of $18,629,800, while operating expenses, yet more remarkably, increased $18,988,300, leaving net earnings $358,500 less than in 1902.

While there is a basis of fact for statements often made to the effect that the Illinois Central has under consideration the electrifying of its suburban service at Chicago, nevertheless it is plain that the time for that costly change has so far been successfully postponed by ingenious improvements in locomotive and car design and service. Quick acceleration, divisibility, and the utilization of paying load for tractive adhesion, are advantages that cannot be fully realized except by electric traction, but these advantages by no means constitute the entire problem. With a suburban traffic such as the Illinois Central handles, where stops are frequent, the time lost at stations in letting off and taking on passengers is a considerable part of the total time required to make a run. The most effective way to shorten the time of station stops is by using cars which permit rapid loading and unloading, and of this the Illinois Central furnishes the best example. It is occupied just now in perfecting its steel frame, side door, suburban car (*Railroad Gazette*, Sept. 4, 1903), which can be filled or emptied in one-fifth or one-sixth of the time needed for an end door car. The time during which the cars are kept moving, as compared with the time they are at rest at stations, is the measure of value got in high-pressure suburban service. Speed is an important fact, but trains at rest are not only non-earning, they are an unbalanced expense. After the duration of station stops have been reduced by many wide-open doors to the minimum possible, further benefit to the schedule can be obtained only by more rapid acceleration and higher mean speed. This means heavier motive power, but the Illinois Central is not confronted with that necessity at present. The studies which its officers have made for electrifying the service have not convinced them that in the important considerations of speed and economy of operation they are at present justified in substituting electricity for the existing motive power.

Railroad Investments of Savings Banks.

The annual report of the Bank Commissioners of Connecticut shows that the savings banks of that state number 90, with total assets of $224,199,772, deposits of $212,177,974, and surplus of $7,942,873. The conservative prosperity of the group of 90 banks is attested, not merely by the foregoing figures, but by the fact that 87 of the 90 banks, with deposits of $211,283,390, paid last year dividends ranging from 3½ to 4 per cent.—57 banks, with $133,488,552 deposits, paying 4 per cent. The returns also show that of the $224,199,772 of assets, $75,730,154, or about 33 per cent., is invested in 11 railroad stocks and bonds, which means, practically, all in bonds, as the state law does not allow investment in railroad stocks, and the "railroad stocks" referred to presumptively are trifling amounts, taken for debts. The Connecticut banks hold now more railroad bonds than of any other class of security, even loans on real estate ($71,398,064), falling considerably below them. Such a large relative, as well as absolute, investment of the Connecticut savings banks in railroad bonds not only explains the strenuous efforts of private interests at each session of the state legislature to get new classes of railroad bonds admitted to the "savings bank list," but has a history of its own showing broadly the important bearing of state laws on savings bank investment in railroad securities.

Up to five years ago the law of the state relating to savings bank investment in railroad bonds was extremely restrictive. The banks could invest only in first mortgage bonds of railroad companies which, for five continuous years, had paid a dividend of not less than 4 per cent. on all outstanding common stock; and, in addition, in bonds of roads within the state issued to refund earlier bond issues. The law, satisfactory in earlier years, became too severe with the progressive decrease of the interest return on high grade railroad bonds; and, in 1899, by concerted action of the banks, a more liberal investment law was secured. Under the new statute the banks can invest in any of the bonds of 11 of the New England railroad companies; the consolidated refunding bonds of any railroad company chartered by Connecticut and consolidated refunding bonds of 14 outside railroad corporations, provided they have paid dividends for five years preceding the investment; and bonds specifically named of some 20 other railroad corporations.

The change of the trend of Connecticut savings bank investment under the new statute during the last five years has been exceedingly impressive. Using round numbers, the assets of the banks rise from $173,925,000 in 1898, to $224,200,000 in 1903. Loans on realty rise from $64,898,000 to $71,398,000; municipal and state bonds increase only from $43,183,000 to $43,225,000; while railroad bonds rise from $36,095,000 to $75,730,000. With an increase of about 29 per cent. in total assets, realty loans have risen about 10 per cent., municipal and State bonds hardly changed, and railroad bond investments have more than doubled. And during the year ending October 1, 1903, out of $9,307,000 gain in assets, $6,269,000, or about 67 per cent., were invested in railroad bonds. Moreover, as, in Connecticut, the law for savings bank investment applies to trust funds also, the savings bank returns only measure in part the demand for high class railroad bonds following the change of the law.

The last legislature of Connecticut made the new departure of opening to savings bank investment the funds of the two large and prosperous companies which own the trolley systems of Hartford and New Haven. The bank commissioners make no separate returns of savings bank holdings of such bonds and the amount of those holdings is undoubtedly small. But the precedent is established, and the first step taken toward adopting the policy of Massachusetts, where street railway bonds are open to savings bank investment if the state railroad commission certifies that the issuing corporation has earned not less than 5 per cent. on stock for not less than five consecutive years. Connecticut could with greater safety adopt such a general statute if she had not blindly allowed her street railways to be over-capitalized up to more than $80,000 a mile, as compared with about $48,600 a mile in the sister State. In this connection may be noted an attempt to push through the last Connecticut legislature a bill—which passed the Senate, but failed in the lower house—legalizing for savings banks the bonds—about $2,000,000—of a street railway company which, as the report of the state railroad commission just published shows, earned last year but a trifle above operating expenses and taxes.

The remarkable absorption of railroad bonds by the savings banks of a New England state has some significant features, both positive and negative. On the positive side will be noticed the quick responsiveness of investment to a changed state law, and the expansion of the market for bonds when a single set of financial institutions in a small commonwealth takes up and withdraws permanently from the market almost $40,000,000 of such securities in five years. On the other hand must be pointed out a certain danger when a legislature allows itself to drift away from general statutes for savings bank investment, begins to "specialize" in favor of particular corporations and opens itself to the onset of paid lobbies seeking a larger market for undigested securities.

Two Types of Railroad Commissions.

The Massachusetts Railroad Commission is a body vested by the State legislature with large power and responsibility in regard to both steam and electric roads. It has purview not only of questions of construction, traffic and public convenience, but of finance and capitalization; and it is not, as we assume, a political body. It stands far and away ahead of the other railroad commissions of the country, and ranks well up to an ideal type. It has blocked many schemes of railroad inflation, and has been the terror of not a few would-be "promoters"; as a kind of high railroad court, whose decisions are generally final, it has enforced the statutes consistently; and, under such a law for capitalization as the "cost of replacement" act of Massachusetts, the commission has kept down the stock and debt of street railroads in the State to $48,621 a mile. Finally the annual reports of the commission are full, accurate and intelligent, expressing the results of announced policy carried out. The last report for 1903 of the commission, recently reviewed in our columns, is no exception to the cheering rule.

There lies before us another type of report, that of the Connecticut railroad commission. It is the annual statement of a "political" body, two of whose three members are respectively an ex-Congressman and a former chairman of a State Central Committee—neither of them by antecedents or training versed in railroad affairs. The record of such a commission and some flaws of its annual report are worth analysis as a suggestion of what a State railroad commission ought not to be.

That the figures and computations of such a report should at least be accurate is axiomatic. Turning to page 35 of the report for 1903, it will be found that the issued capital stock of Connecticut street railroads is given as $45,122.96 "per mile of main line"; bonded debt, $34,931.36 "per mile of road owned"; and floating indebtedness, $4,440.05 "per mile of road"; while the "total stock, bonds and floating indebtedness per mile of road owned, including sidings," is returned as $71,728.50. We pass the lack of homogeneity in such expressions as "main line," "per mile," and "road owned"—as well as the failure of the total sum to square with the three items—and take another and conclusive test. In the report (page 34) the total main track mileage, including sidings, is returned as 642.383 (six hundred and forty-two and three hundred and eighty-three thousandths) miles, and this includes about 44 miles of street railroad in Massachusetts and Rhode Island. The 642.383 miles is, therefore, the largest possible divisor of the $50,001,078.82, which is the sum of stock, bonds and floating debt. The quotient, omitting cents, is $77,836, instead of the $71,728.50 stated in the report. Any reduction of the divisor of course increases the disparity between our own figures and those of the report.

The error is apparently a repeated one. Turning to the report for 1902 (page 37) we annex "verbatim et literatim" the cognate figures with their reference,

as will be noted in each case, to "per mile" of road:

CAPITAL STOCK.

The capital stock of all the street railway companies of the State authorized by charter is $32,232,000, and the amount actually issued $23,571,248, amounting to $45,552.35 per mile of road.

BONDS ISSUED.

The bonded debt of all the companies is $17,488,000, being $33,796.24 per mile of road.

FLOATING INDEBTEDNESS.

The floating indebtedness of all the companies is $1,929,914.34, being $3,729.63 per mile of road. The stock, bonds and floating indebtedness per mile of road are $72,215.98.

The total of $45,552.35 + $33,796.24 + $3,729.63 is $83,078.22, not the $72,215.98 officially returned.

Glancing at the steam railroad returns one finds (page 16, report of 1903) such a palpable error as this: "Cost of roads, $119,472,978.74; cost of equipment, $13,005,977.23 . . . The average cost of the road is $78,055.79 per mile, and the average cost of the equipment, $84,847.78 per mile."

But the sins of the Connecticut railroad commission are not limited to inaccurate returns. Looking back through the yearly reports, one finds that the total capitalization of street railroads has risen during the last eight years from about $59,000 to about $83,000 a mile—as compared with $49,120 and $48,621 in Massachusetts—and this without a word of comment or criticism by the commission on over-capitalization so far as we can discover. The report of 1901 shows that a single corporation, controlled by an outside syndicate, blanketed itself with a mortgage of $9,350,000—based on stock and bonds of purchased roads—and issued stock of $15,000,000, or almost double the stock outstanding of all the other street railroads in the State. This was done with but a relatively trifling addition to properties, and was duly charged up to "construction and equipment account." The commission, without comment on the transaction, allowed the company the benefit of a separate capitalization, construction and equipment account, and the same year entered the company's statement in the regular returns—this in spite of the fact that the laws of the State penalize defective returns, order the commission to compel their correction, and allows it to summon and examine witnesses under oath. The passive attitude of the commission may be suggested further by the fact that when, some eight years ago, it was found that the State legislature had provided for street railroad returns, but not for their publication, it was only through the accidental discovery by a private citizen at the office of the commission that new legislation was secured for printing the figures.

The Connecticut railroad commission, as distinguished sharply from that of the sister state of Massachusetts, is but one example representing a type. That type reveals to us a form of commission which, besides large powers imposed directly and specifically over the physical affairs of the roads, is given large permissive powers also over such matters as railroad financing. In addition they can, if they choose, exercise a mighty influence by recommendation, suggestion and insisting on enforcement of railroad statutes. But the type is passive and timid. It has no "policy." It does not dare to urge remedial legislation or challenge the forces of the lobby, or offend the appointing power. It lacks initiative and voluntary action. It is almost always non-expert and political. And it occupies itself more with the task of securing its own succession than with the conscientious performance of duty. The type is a persistent and depressing one, but the example and record of the Massachusetts commission show at least that a higher type is possible.

Mr. Mellen and Mr. Havemeyer on Publicity.

Since becoming President of the New York, New Haven & Hartford, Mr. Mellen has made a number of notable addresses before the commercial organizations of New England cities, and has succeeded in changing the old-time attitude of local hostility to the railroad to one of interest in its plans and expectancy. The following extracts are taken from the most recent of these addresses:

Publicity not secrecy will win hereafter. Corporations must come out into the open and see and be seen. They must take the public into their confidence and ask for what they want and no more, and then be prepared to explain satisfactorily what advantage will accrue to the public if they are given their desires, for they are permitted to exist not that they may make money solely, but that they may effectively serve those from whom they derive their power. To my mind the day has gone by when a corporation can be handled successfully in defiance of the public will.

Violent prejudice exists toward corporate activity and capital to-day—much of it founded in reason, more in apprehension—and in a large measure it is due to the personal traits of arbitrary, unreasonable, incompetent and offensive men in positions of authority.

The accomplishment of results by indirection, the endeavor to thwart the intention, if not the expressed letter of the law (the will of the people), a desire to withhold what is due, to force by main strength or inactivity a result not justified, depending upon indifference of the claimant and indisposition to become involved in litigation, have created a sentiment harmful in the extreme and a disposition to consider anything fair that gives gain to the individual at the expense of the company.

Compare these liberal views with the statements recently made by H. O. Havemeyer, President of the American Sugar Refining Co., to the effect that special information will not be given to individual stockholders, that figures and information are a bad thing for the public because the public is not competent to understand them, and that a business corporation is an aggregation of individuals, and there are obvious objections to giving to competitors information about corporate affairs—that is to say, the affairs of a union of individuals, which a partnership or individual is not compelled to make public regarding its or his own affairs.

If Mr. Mellen is somewhat in advance of the prevailing opinion of railroad managers, it is certain, says the *Wall Street Journal*, that Mr. Havemayer is fully twenty years behind him, which is equivalent to saying that railroad corporations, in their relations to the public, are far in advance of industrial corporations. The comparison only touches on the difference between an industrial corporation and a public service corporation, and does not deal with the general and fundamental differences between open corporations and close ones, but Mr. Havemeyer's remarks are exceedingly interesting as showing the dread of the old-fashioned business organization for sunlight; a dread formerly shared by railroads and industrials alike. Mr. Mellen, of the opposite school, is giving constant illustrations of the advantages of dealing frankly and openly with a critical and suspicious public, and if he carries his views somewhat definitely ahead of many railroad managers, it is nevertheless probable that they would agree with him that the enforced publicity of recent years has not proved much of an evil, and that whatever harm is done is likely to have many compensating advantages to offset it. The public may or may not be "competent to understand" figures and information, but it likes to try to do so, and is distinctly amenable to this kind of flattery.

NEW PUBLICATIONS.

Manual of Corporate Management. By Thomas Conyngton. New York: The Ronald Press.

This is a book of 331 pages, 6 in. x 9 in., telling just how to do all the formal corporate duties of a company officer, including a compliance with the laws and with common sense. Its character will be suggested when we say that more than half of the volume is taken up with forms and explanations of them. The collating and arranging has been done with intelligence and care. The ample spaces allowed for tabular matter and the large, clear type make the book easy to use, while yet these features do not unduly swell its size. The book is made to conform to the statutes of New York and New Jersey, but of course contains a great deal of information that is useful in all states. The forms are mostly copies of actual documents, given in full. As the author well says, this is better than to leave blanks—often puzzling—for the user to fill up, for, in adapting to your own use a document that has been used by another, the more completely you know what he did the more quickly do you find out what to do in your own case. The first part of the book contains (1) General Information, and (2) a chapter on the Charter. Part 2 deals with By-Laws and Part 3 Procedure at stockholders' and directors' regular and special meetings. As before intimated, the forms are numerous and appear to cover all conceivable needs. For example, Chapter 25 contains four forms for the resignation of a director, two for the resignation of a president and one for a treasurer. There is the form of a New York charter and one of a New Jersey charter. The organization of corporations is treated only incidentally, organization being such a large subject that the author intends to make another book on it.

TRADE CATALOGUES.

Power Station Specialties is the title of a pamphlet which describes the power house auxiliary machinery for vacuum making and boiler feeding recently developed by the Geo. F. Blake Manufacturing Company, New York. The list includes rotative dry vacuum pumps, vertical cross-compound, "Simplex," boiler feed pumps, Admiralty type surface condensers, with combined air and circulating pumps, vertical twin air pumps, combined pot-valve, outside-packed-plunger duplex feed pumps and centrifugal pumps for circulating condenser water. This apparatus has been designed to meet the requirements of steam turbine and reciprocating engine units of 5,000 to 10,000-h. p. capacity, using steam of 200 to 300 lbs. pressure.

Atlas Car & Mfg. Co., Cleveland, O., has just issued a 100-page illustrated catalogue of the numerous types of mine and ore cars, dump cars of every description for smelters, furnaces, cement works and general use, charging barrows, dumping buckets, industrial railroad equipments, switches, crossings, etc., which it makes. Each of the types of cars is illustrated and has a brief description and specification accompanying the engraving. The cars shown cover almost all requirements, with some slight modifications, perhaps; but the company is prepared to submit designs for special cars for any service.

The New York Central has issued a World's Fair pamphlet which contains excellent maps of the St. Louis Exposition grounds and illustrations of the buildings, together with a condensed catalogue of the chief shows of the Pike, and other interesting features of the Exposition which have not received much press notice as yet. The Exposition will open April 30. The buildings occupy 131 acres, while those of the Columbian Exposition at Chicago occupied only 82 acres. The entire space covered by the St. Louis fair is 1,240 acres, which is twice as large as any previous exposition.

McLeod's Labor-Saving Specialties is a 32-page pamphlet forming desk catalogue No. 56 of Walter McLeod & Co., Cincinnati, Ohio. These specialties comprise pneumatic air painting machines, whitewash sprayers, blacking swabs, oil rivet forges, blow torches and sand blast; the Buckeye light; the Buckeye heaters for heavy metal heating; asphalt surface heaters, and portable lead-melting furnaces.

"Industrial" Railway, made by the C. W. Hunt Company, West New Brighton, N. Y., is fully described in catalogue 038, which has recently been issued. In addition to the large number of illustrations, showing the many standard and special types of cars, the catalogue also contains valuable information of interest to engineers and architects.

Little Miss Zenoleum is the annual reminder of the Zenner Disinfectant Company, Detroit, Mich. It is a color photograph of an original water-color painting owned by the company, and is dainty and attractive in appearance. A white mat bearing simply the title of the picture in gold letters is attached to the card ready for framing.

The Rock Island's Repair Shops at Moline, Illinois.

The Chicago, Rock Island & Pacific's new locomotive repair plant and storehouses at East Moline, Ill., is an undertaking of more than ordinary interest both because of its size and because of the orderly and somewhat peculiar method of designing it and equipping it.

On Jan. 15, 1903, a committee was appointed which, as subsequently modified, consisted of M. K. Barnum, Superintendent of Motive Power; S. F. Forbes, Assistant Purchasing Agent, and C. A. Seley, Mechanical Engineer. This committee was assisted by C. H. Wilmerding, Consulting Engineer. In about three weeks this committee prepared a preliminary plan which was immediately approved, and the making of the detail plans, specifications and letting of contracts went forward without delay. The buildings were designed and constructed by the George W. Swift Company, of Chicago, and with the tracks occupy a tract of land a mile and a half long and a quarter of a mile wide. Construction was begun on May 1, 1903, and since then about 600 men have been constantly employed.

The freight yard has room for 35 tracks, and as at present laid out has a capacity of 3,000 cars.

Water is got from the Mississippi River; from the power house to the pumping station, 9,600 ft., from the pumping station to the river, 400 ft., and to the end of the intake pipe, 750 ft. The station has two triplex pumps of 1,000,000 gals. capacity each. One is direct-connected to a 60-h. p. gasoline engine and the other to a 50-h. p. electric motor. The intake is 12 in. in diameter and the main line to the plant 10 in. diameter. There are two tanks at each plant of 100,000 gals. capacity. The fire service tank is 108 ft. high.

All the buildings are drained into a system of storm water sewers of a total length of 10,600 ft. These are 6 in. in diameter at the beginning, increasing to 8 in. The sewage disposal plant consists of two septic tanks, with four filter beds for each tank. Each tank holds 35,000 gals. and when in full operation is emptied every day. The four filter beds are 24 ft. square, each designed to be in service a quarter of the time, and are automatically cut in and out. The beds are filled with front-end-locomotive cinders 4 ft. deep overlaying a layer of 12 in. broken stone. There are 4,700 ft. of sanitary sewers.

From May to December, 1903, eight buildings were put up, as follows: Machine, erecting and boiler shop; blacksmith shop; storehouse; power house; refined oil house; crude oil house; engine house, and Master Mechanic's office. The principal building for the erecting, machine and boiler shops is under one roof and covers 5½ acres. In this building 1,800 tons of structural steel were used and the committee and desiging engineers congratulate themselves that although this material was prepared at three different plants of the American Bridge Company there was not a single misfit measurement or shop error. This statement is also true as to the other buildings.

Almost the entire tool equipment of the shops is new, and only such tools will be transferred from other shops as are first-class and up to date. Two hundred tools have been bought and are almost all delivered and set up. All tools which do not require crane service for handling the material to and from them have been grouped and driven from separately driven line shafts. A few of these machines have special foundations, but as the floor is underlaid with concrete, that is deemed sufficient for the majority of the tools. The heavier tools which require crane service, some 25 in number, are individually motor-

driven; most of them with motors having a 4 to 1 speed variation, supplemented in some cases by gear changes when an additional range is necessary. There is no machinery in the erecting shop except a 17-ft. gap riveter at one end in a pit, served by a special crane in the roof framing above the larger crane runway. The majority of the tools in the boiler shop are hydraulically operated. Somewhat of a departure has been made in equipping the boiler shop, as the hydraulic method has been employed for nearly all of the punching, shearing, flanging and riveting machinery. About 66 per cent. of the boiler shop, 100 per cent. of the erecting shop and 50 per cent. of the machine shop will have crane service, and in some bays a number of cranes will be operated in order to cover the necessities.

The amounts of material used in this work were as follows: About 5 million feet of lumber, 6 million brick, 2,400 tons of structural steel, 150 tons of cast iron, 64,000 sq. ft. of factory ribbed glass, 20,000 ft. of wire-glass skylights and 420,000 sq. ft. of composition roof. The foregoing notes were furnished by Mr. C. A. Seley, Mechanical Engineer.

Motor Cars on the Wurtemberg State Railway.*

After continued experiments which date back to 1893 the Daimler Company has developed for the Wurtemberg State Railways, the motor car shown in the illustration. This car carries 56 passengers and with this load makes 16 miles an hour on a 1 per cent. grade, and 10 miles an hour on a 2.6 per cent. grade.

The results have proven so satisfactory that the Wurtemberg Railway has put five cars in service, and the Swiss and Austrian railroads and a Hungarian line have each a car, while a ninth, of the same type, has been ordered for the Saxon State Railways.

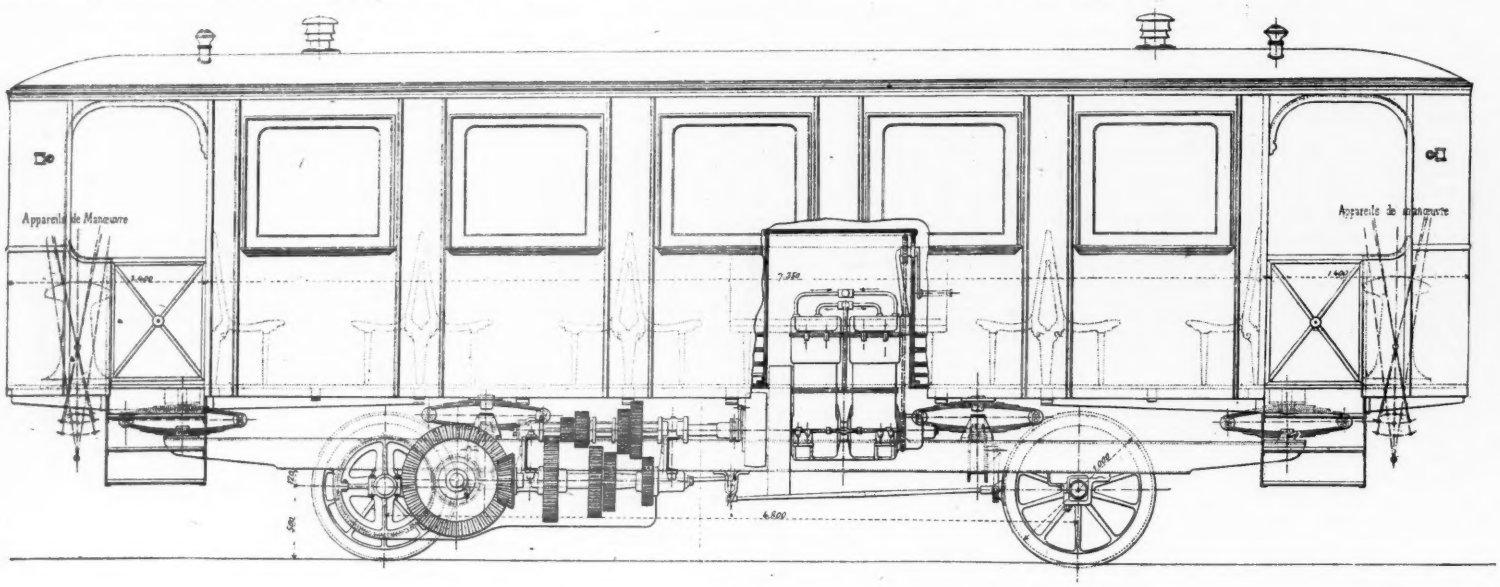
The motive power is furnished by a 30 h.p. four-cylinder gasoline engine carried in the center of the car with cylinders 5¼ in. in diameter by 6¾ in. stroke. The engine speed is from 600 to 800 r.p.m., and the cranks are set at 180 deg. The cylinder heads come up into the body of the car, facilitating inspection and lubrication. The exhaust is carried up to the roof. Controlling apparatus is placed at both ends of the car so that it can run in either direction without being turned. The arrangements for transmitting the power to the driving axle and for starting and controlling the engine are similar to those on an automobile for the road. By means of three pairs of spur gears speeds of 4½, 8, 14 and 22½ miles an hour are obtained.

The car is ventilated by a fan which introduces through the floor, either fresh air or air which has been warmed by the radiator of the engine. The vitiated air is taken out by two ventilators in the roof. The wheel-base of the car is 15 ft. 9 in. The gasoline tank holds 220 lbs. which is sufficient for a run of about 217 miles. The weight empty is about 27,500 lbs. As will be seen from the illustration, the machinery is carried by a frame entirely independent of the car body which rests on this frame through elliptic springs. The cylinders are water cooled, with circulation maintained by a pump.

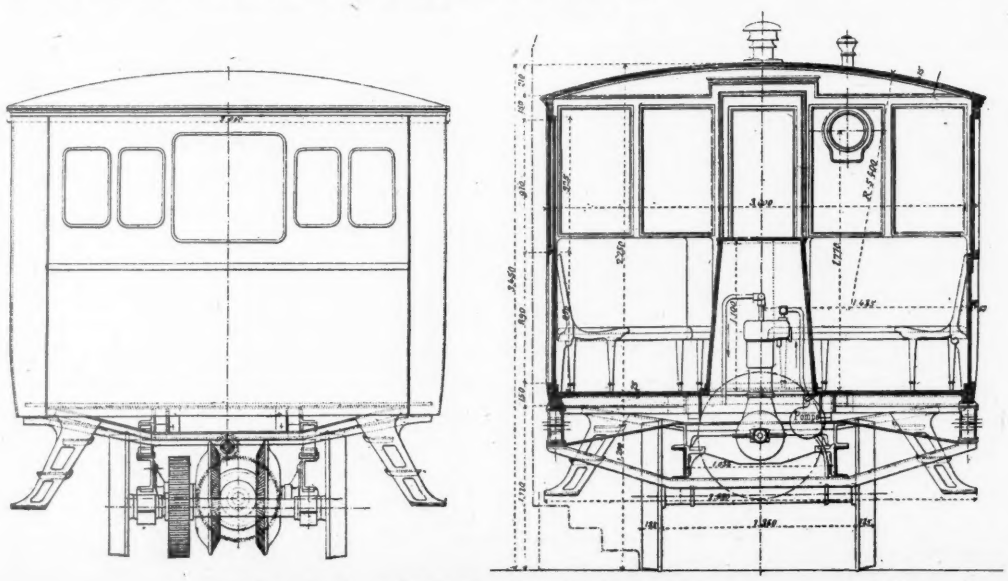
The cost of a car is $7,500. Those in service have worked satisfactorily and in the last four years have averaged about 28,000 to 31,000 miles each, the cost of maintenance being comparatively slight. With an average car mileage of 93 miles a day, the running expenses per car-mile are, gasoline 3.4 cents, lubrication 0.42 cents, and adding $1.25 for motorman and 75 cents for conductor the total operating cost per car mile amounts to 5.96 cents.

This type of motor car is easily run and is well adapted to the economical handling of traffic too light to pay for running a regular train drawn by a steam locomotive.

*Abstract of an article in the *Revue Generale des Chemins de Fer* for November, 1903.



Plan and Elevation of Daimler Motor Car for the Wurtemberg State Railways.



Cross Section and End Elevation of Daimler Motor Car.

Foreign Railroad Notes.

The Leipsic firm, Adolf Bleichert & Co., is building on the Argentine side of the Andes for a mining company what will be the longest cable road in the world, with the highest engine station. It will extend from Chilecito station of the Argentine Northern Railroad, which is 3,430 ft. above sea level, for a distance of 22 miles, to a point 14,933 ft. above the sea, which is 1,300 ft. higher than the top of the Jungfrau. The route is over a chain of rocks and precipices; in places the cable spans chasms 2,800 ft. wide, with the valley 650 ft. below at its deepest point. In other places iron towers 130 ft. high support it. All parts must be carried on mules to the place where erected. About 2,200 tons of materials were shipped from Antwerp for the work, in 16,000 bales and boxes. The length of the wire rope used is 87 miles. The line is to be able to carry about 44 tons of ore per hour, a car holding 1,100 lbs. being despatched every 45 seconds. The work has already made good headway, and a part of the line is soon to be opened.

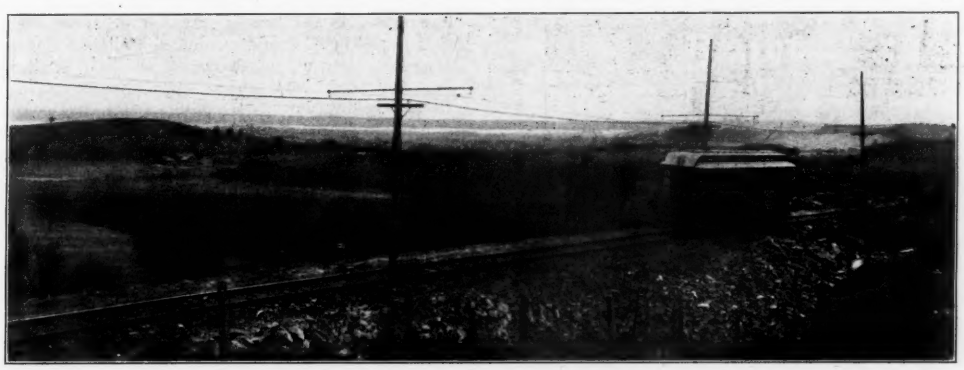
Facilities for making coffee were provided at certain German railroad shops, where the men clubbed together to provide and make the coffee, which was sold at nearly cost price. It was taken almost universally, and in winter in large quantities, while the consumption of beer, which was supplied at the same place, fell off to a marked extent.

In November the excavation of the Simplon Tunnel advanced 262 ft. at the north end and 569 ft. at the south end. A hot spring encountered on the north end caused the suspension of work with power drills for nine days. The number of men at work was 3,524, of whom 953 were employed outside.

Traffic Development on the Auburn & Syracuse Electric.

In the review of the operations of the electric lines in northern New York State, printed in the *Railroad Gazette*, Aug. 1, 1903, mention was made of the Auburn & Syracuse road, which runs between the points named, paralleling the Auburn road of the New York Central at a distance of from three to five miles. At the time the previous article was prepared, however, the electric road had only been in operation a few weeks, and it was, of course, impossible to get any operating statistics of value, because the traffic of an interurban road opened in the summer months is sure to be abnormal, made up chiefly of excursionists and those who are taking the ride for the novelty, but lacking the regular traffic which becomes developed later on. Through the courtesy of R. A. Dyer, Jr., Assistant General Manager, we are enabled to print some figures relative to the operation of the Auburn & Syracuse road, which has now been running a trifle over six months.

The distance from Syracuse to Auburn via the electric road is approximately 28 miles. On the steam road it is approximately 26 miles. Between Syracuse and Auburn the electric road passes through Split Rock, Howlet Hill, Marcellus and Skaneateles. The steam road does not reach any of these points direct, although



Auburn & Syracuse—Ballast on Private Right of Way.

stations are maintained at Marcellus and Skaneateles Junction. The running time from the center of Auburn to the center of Syracuse on the electric road is 90 minutes, as against approximately an hour on the steam road, and tickets are sold for 40 cents one way and 70 cents round trip between Syracuse and Auburn. The hourly service since late in the fall, and the 35 minute service in the summer time, combined with the fact previously noted, that the towns are from three to five miles away from the steam road, has resulted in the electric road getting approximately all the short haul traffic between Syracuse, Marcellus and Skaneateles. The number of passengers carried daily between Auburn and Syracuse on the electric road ranges at this season of the year from 90 to 110 on the average, which is believed to be approximately twice the number of round trip tickets that the steam road sold previous to the opening of the electric line. The service begins at 5.30 a.m., and the last car leaves Syracuse for Auburn at 11 p.m., after the theaters are out.

Express and light freight business has not yet been developed but two express cars are now being built for the company and will handle the same class of goods as on the other lines previously described: practically everything, that is to say, except bulky freight.

The accompanying photographs show the relatively substantial manner in which the line has been built. About 17 miles of the line out of a total of 28 is on private right of way. The roadbed is ballasted throughout the private right of way with broken stone or with gravel, and the rail is of 70 lb. section. The previous description of the lines in this locality contains a map showing the Syracuse & Auburn line and also the Auburn road of the New York Central.

The Maximum Economical Load for a Locomotive.*

Experiments are quoted in a paper read before the last Master Mechanics' convention, which show that, notwithstanding a revenue ton of coal in a 40-car train was hauled at a much less expense for fuel and wages than in a 45-car train, the extra revenue from the 45-car train was $91.79 in excess of the increased expense of hauling the additional five cars. So, in comparing total revenue of the two trains, we find that the 45-car train was really the most economical, fuel and wages the only expense considered. But this would follow only when comparison of the two trains is made for a limited interval, as the comparison between two single trips. This result is very radically changed when we consider a longer interval of time, say 30 days, or 720 hours, and assume that the engine is in constant service.

It took 22 hours to make one trip with the 45-car train, and 17 hours with the 40-car train. We will allow a lay-over of eight hours in each case for necessary repairs, etc. The engine with the 45-car train would make 24 trips in the 720 hours, during which time 26,160 net tons would be hauled at a revenue of $23,544. The engine taking 40 cars each trip would make 28.8 trips, hauling 31,104 net tons, at a revenue of $27,993.60. This would be $4,449.60 in favor of the 40-car train. The expense of hauling the 45-car train, which includes wages of train and enginemen and cost of fuel consumed, would be $1,883.76, as against $1,404.86 for the lighter trains. We thus see that the total revenue for the lighter trains would be much more, and the expense of hauling considerably less, than with the maximum train.

In commenting on these figures, it seems almost impossible that the addition of five cars to a 40-car train would cause the locomotive to burn nearly double the amount of fuel. The thought also comes as to what the result would have been if the load had been further reduced five cars.

Regarding all expense of maintenance in each case, without doubt that of the lighter train would be the most favorable. The liability of engine failures would be lessened, the locomotive would be in service more continually, the cost of repairs would be much less, the time between terminals could be materially shortened, which alone would tend toward economy, there would be fewer car failures, and, not least important, the smaller power necessary with the lighter trains. Until we have designed an engine that will haul its maximum load without failure, we must count on the service of the average engine as now designed. There is no doubt but what the time factor is the critical one, and it would appear that this is not always as carefully considered as it should be.

It is usually the custom on most railroads to make the schedule time of freight trains much slower than passenger trains. We can readily understand why this might be necessary when the time of the passenger trains is fast, and also in the case of way-freights. But in runs where the time of passenger trains on account of grades is reduced to a speed of 15 or 20 miles per hour, there seems to be no good reason why through freights cannot have the same schedule time as the passenger trains.

There is a dearth of data relative to experiments that have been made to determine the most economical speed for freight trains, but the results of such experiments as have been made to determine this point indicate that a speed of from 15 to 20 miles per hour is more economical than slower speeds. This would more properly apply where the limiting grade is nearly continuous.

As long as the requirements of service necessitate the "pooling" of the engines on any road, the lighter load would tend favorably toward fewer engine failures; at the same time, as far as failures are concerned, the single crew would make a greater difference than a variation of load.

Again referring to the load, it is evident that, in determining the economical load for a locomotive, each engine run should be considered independently of the others. If the limiting grade between terminals of an engine run is short, and the remainder of the run comparatively level, then the economical load may be the maximum that the locomotive can haul over the limiting grade, present conditions of weather and track considered. When the limiting grade is continuous, a lighter load would doubtless be the more economical.

In conclusion, making our deductions from what we have in evidence, and taking into consideration the conditions as they are usually on a railroad, it is evident that the maximum load is not the most economical, except in cases where the limiting grade, governing the given load, is short. The time factor is one of the greatest importance in determining the economical load. In determining the hauling capacity of a locomotive, on account of the wide variation of the ratio of cylinder power to the weight on driving wheels of the various designs of engines, it would be better to use a certain per cent. of the weight on drivers, rather than the calculated tractive power. Special tests of locomotives to determine their hauling capacity are, as a rule, of little assistance, because the conditions governing the tests are usually the best, and unless reasonable deductions are made to suit the regular every-day service, much trouble and annoyance ensue. Great care should be exercised in the designing of new locomotives, that the many failures to which they are liable may be avoided, as these in a great measure govern the successful load the locomotive can haul.

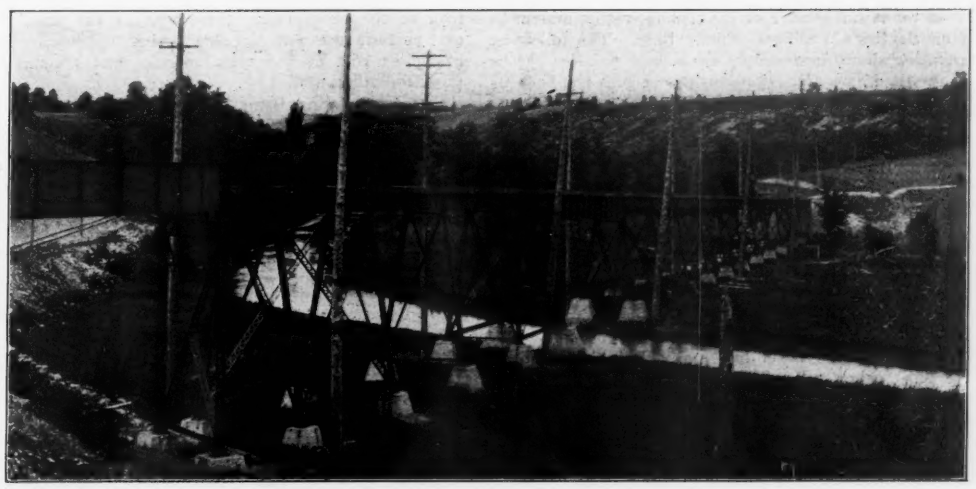
EXTRACTS FROM THE DISCUSSION.

Mr. B. A. Worthington: The paper just read involves the tonnage-rating system, and when the details of the system are thoroughly understood, all railroad men will appreciate the approximate accuracy with which the engine-ratings have been made, and will see the value of the system from results that have been produced.

The present tonnage-rating system on Southern Pacific Company lines is based upon time, and in each case of engine-rating, a time-load diagram is furnished the mechanical engineer, showing the speed of the time-line for the load that is plotted between stations over the freight run for which the engine-rating is made. To determine the relation between train-speed, load and engine-power, we used as a basis for train-resistance the curve developed by the late Arthur M. Wellington, which was deduced from exhaustive experiments with a dynamometer car on the Lake Shore & Michigan Southern. While later resistance curves showing less resistance have been developed, the effect of the adoption of one of the later curves would be to increase the present load per unit of engine traction, which would not seem to be practicable, for the reason that whatever complaint is now being made would indicate that the load is too high, rather than too low. For rating purposes, the resistance would naturally be taken at the limiting point of the run, where the engine would be working the hardest, which we have assumed to be 10 miles per hour, although in daily practice trains are often kept moving even at as slow a speed as three miles per hour, and an engine is necessarily exerting a higher traction at this speed than at 10 miles an hour; therefore, a rating based on 10 miles an hour would be in favor of the engine.

The motive-power department prepared a mean effective pressure-curve from steam-indicator cards taken from a large number of engines, and as the lines of this curve fall about on the middle ground up to 300 ft. per minute piston speed, between such standard authorities as the Master Mechanics' Association and the Schenectady Locomotive Works, we naturally concluded that this curve, which allowed for the drop in traction with the increase in speed, could not be far astray.

It is well understood that the energy gained by momentum can be reconverted into work at any time, without loss, and in running our time-lines we have used the Wellington formula. We checked over each section of track, plotting the equivalent grades, making due allowance for resistance from curvature and, as indicated, constructing an operating profile. Following out this method velocity heads were plotted on the operating profile at different points along the track and lines drawn joining these velocity heads measuring the grades, the resistance from which equals the power consumed or required by change of speed or elevation. From these lines a table was prepared showing the loads in M's that could be taken at different speeds for each section of track on each freight run. From this table a time load diagram was made, based on the most economical load consistent with the time limit that could be taken per unit of engine power. To be on the safe side, all time lines were based on trains of empty cars, the resistance per weight unit of which, as is well known, is greater than for loaded



Auburn & Syracuse 600-ft. Bridge near Marcellus, N. Y.

*Abstract of a paper by Mr. C. T. Noyes, read before the Pacific Coast Railway Club, December, 1903.

cars. Constructive weight allowance for empty and underloaded cars was fully considered, making due allowance for gradient sections, because of the fact that only the rolling and atmospheric resistances are greater per weight unit of empty cars than per weight unit of loaded cars. This was clearly demonstrated by a series of dynamometer tests made on the Northern Pacific, showing that the draw-bar pull for 18 loaded cars, weighing 672 tons, in 60 empty cars, weighing 669 tons, was nearly the same on a 1 per cent. grade, while on a level the traction exerted was over 50 per cent. more for the train load of empty cars. This is the reason why there is no allowance made for empty or underloaded cars on gradient lines.

From the time-load diagram the mechanical engineer prepares a rating sheet, every engine being rated upon the same basis on each freight run. For example, the time-load diagram may show a load of 100 M's for each unit of engine traction. In this case, each engine would be calculated to take 100 M's for each unit of traction, the traction being figured at a speed of 10 miles per hour, when such traction does not exceed one-fourth of the driver weight. In the latter case a traction equivalent to one-fourth of the driver weight is used. Experience has since taught us, however, that in average practice engines ought not to be rated for 1 per cent. grades and over at a traction that is higher than 21 per cent. of the driver weight, and upon less than 1 per cent. grades, 23 per cent. of the driver weight. As will be seen, the time factor is the essence of the tonnage-rating system in use on Southern Pacific Company lines. The following illustration shows how closely the actual practice checks with the time lines and engine ratings on nine tests on different runs, which I made personally.

In the month of June, 1900, I visited the Tucson Division, making four tests, as follows: Test No. 1 was from Tucson to Gila Bend, 128 miles. Our figures showed that a load of 2,600 M's net weight of train should be taken with a "DA" ten-wheeler, with helper, over the Estrella Hill in 5 hrs. and 15 min., net running time between stations (excluding stops); the actual performance was 2,623 M's in 5 hrs. and 2 min.

Test No. 2 was with this same train and same class of engine, from Gila Bend to Yuma, 123 miles. Our figures showed net running time 6 hrs. and 5 min., while actual performance was 7 hrs. and 14 min., a difference of 69 min., nearly all of which was consumed in a poorly arranged "double" over the Mohawk Summit, where they used 1 hr. and 27 min., and the engine had to be favored at other points, owing to bad water.

Test No. 3 was with the same class of engine, from Yuma to Gila Bend, 123 miles, with net load of 2,127 M's, which our figures showed should consume net running time of 6 hrs. and 13 min.; actual performance was 5 hrs. and 58 min.

Test No. 4 was from Gila Bend to Tucson, 128 miles, with same class of engine, and a net train load of 2,373 M's, which our figures showed should consume 6 hrs. and 51 min. net running time; actual performance was exactly 7 hrs.

For some reason, either through faulty design or otherwise, we have not been able to get the same service per unit of engine traction out of our large modern engines, and have not been able to get the same number of days' service out of these new engines per month as we formerly got out of our old standard engines. It is probably not unreasonable to suppose that, perhaps, we would get better results if we adopted a system of more rigid inspection of engines at terminals, requiring all engineers to report all defects on completion of trips, and having a gang of machinists and boilermakers ready to get to work on an engine just as soon as it is sufficiently cool to permit their doing so, with a view of getting the engine into service as quickly as possible after necessary repairs shall have been made. Many times an engine comes out of the roundhouse, especially in bad water districts, with a boiler leaking so badly that it results in an engine failure before getting over the run. The results in practice indicate that the necessary work on engines is oftentimes not done, and this is the cause of many engine failures on the road. Superintendents and master mechanics should watch the engineer's reports carefully and locate the responsibility. A strict rule should be made that no engine should be turned out of the roundhouse unless able to get over its run without failure.

The case cited by Mr. Noyes shows clearly that there is no economy in overloading an engine; but when engines are able to show a speed of from 15 to 23 miles an hour, which is the case on all the runs which we have been checking for the past several months, with the exception of trains on very heavy grade lines, where the average speed is from 10 to 12 miles per hour, there is no comparison between the case cited and the loading of locomotives on Southern Pacific Company lines.

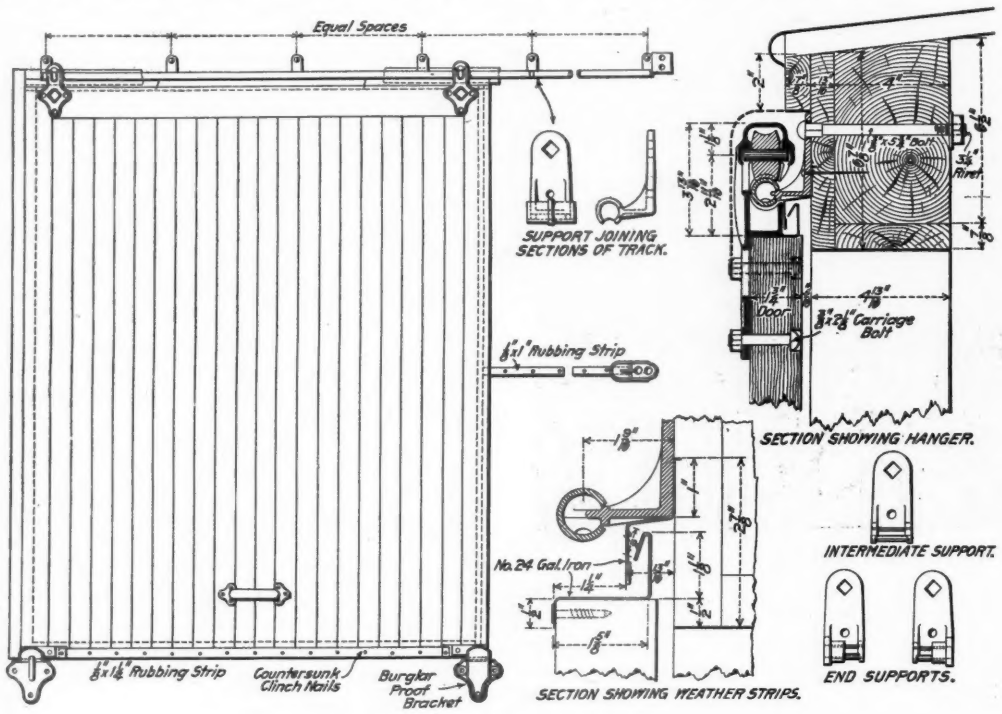
There is no question but that overloading engines is a very expensive proposition, and, in this connection, some fuel tests were made on the various divisions of the Southern Pacific, embracing a total of nearly 15,000 train miles, the results of which showed that with fast trains, running 22 miles per hour, and slow trains, running just half that speed, the fast trains being loaded to 80 per cent. of the load of the slow trains, there was 11 per cent. better coal performance with the slow trains, and nearly 13 per cent. less cost of locomotive service and trainmen per gross ton-mile handled.

The freight-train statistics of freight-train service for the Southern Pacific Company for the year ending June 30, 1902, show an average speed of all freight trains in miles per hour, excluding stops, of 17.6 miles, which indicates that the train loading reaches approximately what is considered by experts to be the most economical speed.

Indicator cards taken from a simple consolidation locomotive show a traction actually developed of 37,411 lbs. at 10 miles per hour, while at five miles per hour, cut-off at 28 in. on a 30-in. stroke, the traction actually developed was 43,560 lbs., or equivalent to 24.2 per cent. of the driver weight. This test conclusively sets at rest two points:

1. That in rating engines at 10 miles per hour, they are not rated to their maximum capacity. Consolidation engines on the Sacramento Division are rated on the basis of 36 units of engine power, which, according to the test just referred to, shows that these engines are rated at about 83 per cent. of the traction that they are capable of developing, without slipping, on the heavy grade lines.

2. From the results attained in daily actual practice, I had about concluded that it was impracticable to work locomotives on grades of 1 per cent. and over up to a traction that would be equal to more than 21 per cent. of their driver weight. The test above referred to shows that this engine actually developed 43,560 lbs. of traction, equal to 24.2 per cent. of driver weight, and the statement of the Engineer of Tests shows that this engine developed this excessively high traction on the heavy grade line without any tendency whatever to slip, demonstrating conclusively that, under favorable conditions, engines will work up to a traction equivalent to almost one-fourth of their driver-weight on heavy grade lines.



Smith Improved Car Door and Details.

The Improved Smith Car Door.

A description of the Smith car door, which embodied some novel features, was given in the *Railroad Gazette*, June 13, 1902. Attention was particularly directed to the rail; the hanger, with rollers above and below the rail; a special sealing device in connection with a burglar-proof bracket, and a storm-proof feature. For protection at the top against the elements a sheet-steel hood was provided. An improved Smith door has recently been brought out, the details of which are shown in the accompanying drawing. Chief among the improvements in the substitution at the top, of weather strips for the hood. The most important advantages derived from this change are a reduction of lateral clearance and a reduction of cost, only 8 lbs. of 24-gage galvanized iron being needed for a 6 ft. 3 in. door, against a considerably greater weight of sheet steel that was needed for the hood.

The design of the hanger has been modified materially. It was found that the lower roller was not needed and the form of the hanger was accordingly simplified and its cost lessened. The roller is mounted loosely on the shaft and in the old hanger this shaft had a shoulder turned on each end, the part of smaller diameter fitting into a slot in the hanger. In the improved design the shaft is without shoulders, and a V-shaped, downwardly projecting tongue, which covers the end of the shaft, has the point bent under slightly to keep the shaft from dropping down.

Another change is in the rail. Formerly it was put up in one piece; for greater convenience in hanging, the track has been divided into two sections and a special support designed to join the two sections. This support and its location are shown in the drawings. The improvements also include some other minor features in design. The doors are furnished with or without the weather strips as desired. The Chicago, Burlington & Quincy has 500 cars and the Michigan Central 700 cars in service with the strips. The doors are sold by the Jones Car Door Co., Monadnock Block, Chicago.

The Downing Metallic Packing.

The application of the Downing metallic packing to locomotive air pumps is shown by Fig. 1 and the details of the metallic packing ring are shown by Fig. 2. The packing consists essentially of a segmental packing ring, BB, follower C, spring E and gland nut H. No change of stuffing box is necessary in order to apply this packing to any pump now in use and in general the gland nuts can be altered to serve the purpose. A swab casing T is wrapped around the gland nuts H, and is fastened with screws which pass through the lugs shown in the engraving. The casing is filled with a swab material. The oil cup O, which is mounted on the bracket P, is connected with the swab by a pipe as shown. In this manner the rod is continuously lubricated and protected from dust, cinders, etc.

The segmental ring is made of an alloy which will stand high temperatures without pitting or melting. The ring is composed of three segments lapped and joined together so that when applied to the rod they interlock and hold together so that they can be moved along the rod. The ball joint surfaces are at such an angle to the rod that the compression of the spring and pressure produce a gentle bearing on the rod, thus preventing excessive wedging.

Various modifications of this packing are made in order to suit special conditions. It is used for valve stems, piston rods, steam engines, pumps, compressors, etc. In

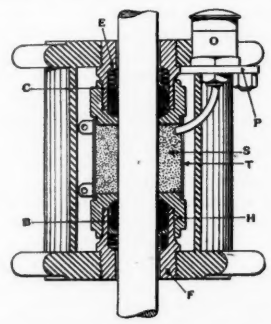
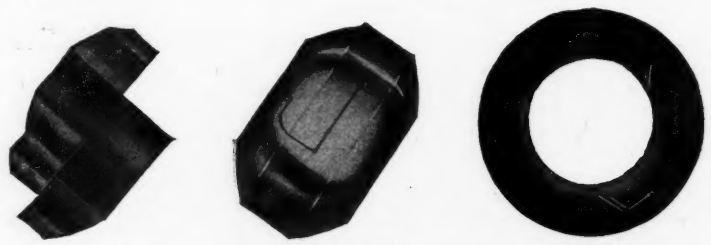


Fig. 1.—Downing Metallic Packing Applied to Locomotive Air Pump.



Interior View. *Assembled Side View.* *Assembled End View.*

Fig. 2.—Downing Metallic Packing Ring.

locomotive service it is guaranteed to last not less than 25,000 miles without renewals and it is claimed that rings have been in service which have lasted for 100,000 miles with a steam pressure of 225 lbs. The packing is made and sold by the N. L. Hayden Manufacturing Company, Columbus, Ohio.

French Work on the Panama Canal.

The New York *Tribune* in a recent issue printed an account, by its Panama correspondent, of some features of the French work on the Isthmus which have a picturesque side, in addition to the moral lesson which they convey. The *Tribune* thinks it goes without saying that the contractors, supervisors, inspectors and administrators under the United States will not steal 200 millions, as did the French, but considers it valuable to know the opportunities for "graft," in order better to watch out for "grafters." Portions of the article follow:

It would have been possible for the original French company to complete the lock canal for the amount of money actually thrown into the enterprise had that plan been adopted at the beginning and the work prosecuted earnestly and honestly. This, though, is exactly what was not done. Years were wasted and millions of dollars flung away, and the French company was on the verge of bankruptcy when it finally decided upon that plan. It was then too late for it to achieve any definite results. France was agog with the tales of corruption in connection with the work; De Lessep's credit was irretrievably shattered, and the end of the string had been reached. These facts did not feaze the French engineer, however, for just when crushing disaster was breeding he made a triumphal trip to the isthmus, occupied his palatial residence on Cristobal Colon Point for one week, unveiled the Columbus statue which the Empress Eugenie had presented to the company, and in a grandiloquent speech declared the canal open to navigation.

At that moment the canal was open to Bohio—open as a narrow, shallow ditch. The thing the French had begun in earnest ended right there, having progressed through monumental tragedy, profligate waste and limitless criminality to the farce of De Lesseps standing at one end of a ditch and declaring a ship canal open to commerce.

Grave as was the error of indefiniteness and indecision committed by the original French company, it pales before the enormity of the crimes committed by those who were actually in charge of the work. From the moment those sent to the isthmus to superintend the construction of the canal arrived until the final crash came, there was a perfect saturnalia of "graft" aided and abetted by the crowd who kept headquarters of the company open in Paris, and who were ready for their share, to pay rascality's demands. There was stealing outright; there was stealing by means of the purchase of superfluous machinery; there was stealing by means of the awarding of contracts at exorbitant prices; there was stealing by the extortion of commissions on every contract awarded; there was stealing in the purchase of the most minor supplies—there was, in short, stealing at every turn and upon every hand, until it may be said that there was not a tool brought to the isthmus nor a yard of work done along the canal route that represented entire honesty.

At the northern end of the waterway the evidence of stealing begins at Cristobal Colon Point. To build a breakwater to protect the entrance of the canal the French built a small paradise—a thousand feet out into Limon Bay and several hundred feet wide. Money was lavished there with appalling recklessness. Instead of building this breakwater with cribs, mats and riprap, as is commonly done, the French used stone cubes three feet on either face. Instead of going to the great stone stretches about Bohio, easily accessible from the railroad and opening quarries for stone, the French awarded contracts for stone, the French awarded contracts for its manufacture out of concrete, and the price paid for each block was $75 (silver), equivalent to about $30 in American gold. Upon such a foundation, constructed at a cost many times in excess of what would have been required for a simple breakwater honestly built, the French made a park, providing waterworks, drainage, sewerage and all modern conveniences; planted cocoanut trees, carted great quantities of sand, and erected mansions for the officers to live in. In the two principle ones are immense quantities of specially designed and decorated silver, in sets and services; cut glass and china of almost priceless worth—all paid for out of the money credulous France subscribed for the building of a canal.

In crossing the railroad fill, from Colon to the mainland, one comes quickly to one of the most glaring of all the available proofs of French rascality. Lying in the mud, soft silt and swamps, are 50 Belgian locomotives, built especially to the order of the Panama Canal Company, and in their day as perfect pieces of machinery as Europe had ever produced. From some of these locomotives the partial crating was never removed, for it was discovered after they were delivered that "a mistake" had been made in ordering them. They were all ordered for a different gage railroad from that on the isthmus and were, therefore, entirely useless. But, instead of being sent back to Europe to be sold where they might be used, they were dumped in the mud, and there they lie to-day.

In the excavated portions of the sea level sections there is visible proof of this same mad work of the "grafters," for from Colon to Bohio, and from La Boca to the end of the excavation the muddy water of the filled in ditch flows through rows of superfluous machinery. At La Boca alone, where the dredging was never extended inland and more than three miles; there lie rotting in the mud scores of dredges, steam, self-propelling dumping scows, launches, etc:—a fleet so large as to have made effective work impossible through the interference of the machines.

A certain firm secured a contract for dredging an important section of the canal on the sea level. It was managed by knowing men; and when they arrived they promptly proceeded to bribe the inspectors detailed to supervise their contract, and all other approachable officials. Millions of dollars were involved in the contract, and this firm collected the whole amount, after its work had been passed upon and approved by the French officials. Go over that section of the canal to-day, and you will find only a narrow ditch, for so perfectly were the contractors protected by the "grafters" upon the French company that they simply picked up the dirt from one side of the dredges and dumped it on the other. In other words, they merely lifted it over the hull of the dredge, the inspectors taking the depth of the excavation on that side where the dredging was being done, ordering full payment for a perfect and completed contract.

That the United States should in any way emulate France in these matters is unthinkable. We start with the advantage of the French example; we shall know by the French experience where to expect "graft," and how to prevent it, and if we should be disposed to be dishonest, the memory of how France stigmatized herself and wrecked the work she undertook should stimulate our honesty and make us to do well and quickly the work France began, to end only in baldest and most unblushing thievery.

TECHNICAL.

Manufacturing and Business.

The Pittsburg & Lake Erie shops at McKees Rocks, Pa., which have been working for three days a week for several months, have resumed full time.

The Vulcan Foundry & Machine Company's works at New Castle, Pa., which have been closed for several weeks for repairs, will shortly resume work.

H. A. Norton, of the Norton Jacks Co., sailed for the Mediterranean and Egypt, for a combined business and pleasure trip, on the "Canopic," Jan. 30.

The Voigt Metal Company, 113 Market street, Camden, N. J., has been incorporated in New Jersey, with a capital of $100,000, to make castings. James G. Foukes, Max M. Robinson and Charles F. Voigt are incorporators.

Mr. W. H. Campbell, for several years Secretary of the Camel Company, Chicago, has resigned to engage in business for himself. Mr. W. W. Darrow has been elected Secretary of the Camel Company, to succeed Mr. Campbell.

The 200 box cars ordered by the Long Island R. R. from the South Baltimore Steel Car & Foundry Co., and referred to in our issue of Jan. 22, will be fitted with Asphalt Torsion-proof roofs, made by F. W. Bird & Son, East Walpole, Mass.

The only bidder for the new dry dock at the New York Navy Yard was the R. G. Packard Company, of New York, which bid $1,082,246, while the amount appropriated for the dock is $1,000,000. Further bids may be advertised for by the Navy Department.

Adreon & Company, Security Building, St. Louis, agents for Paul Dickinson, Chicago, report the sale to the Terminal Railroad Association, of St. Louis, of 117 cast-iron smoke jacks for engine houses 1, 2 and 3, now being built in St. Louis. This is said to be the largest order ever given for a device of this kind.

The business of the S. Obermayer Company, Cincinnati, during 1903 aggregated 4,410 car loads of foundry facings, foundry supplies, plumbago, black lead, etc., or over 80,000 tons. To make the figures more impressive the company reduces them to train loads at 30,000 lbs. per car, getting 178, which, with proper allowances for spacing, it further estimates, would extend over 40 miles.

Mr. J. W. Midgley, of Chicago, announces that he is prepared to examine and report on the earning capacity of railroads, existing or projected, or to investigate traffic conditions and indicate economies. Mr. Midgley served for 21 years as chairman of traffic associations of railroads extending west from Chicago, and has frequently served as arbitrator in traffic cases in different parts of the United States.

The Consolidated Car Heating Company's New York offices will, after March 1, be in the new building at 42 Broadway, Rooms 1747-49. Mr. Cornell S. Hawley, hitherto General Eastern Agent, is now General Sales Agent, with headquarters in New York; M. S. B. Keys, of the New York office, is to be Eastern Representative; Mr. W. S. Hammond, Jr., of the Denver office, is to be Western Representative, with office at Chicago.

The General Electric Company, of Schenectady, N. Y., has established a drafting-room apprenticeship course which covers a period of four years, during which time a small salary is paid. Young men are admitted to this course who are over 16 years of age and who are able to pass a satisfactory examination in arithmetic. The course is intended to fit applicants for drafting-room positions. J. W. Upp is the engineer in charge of the drafting room.

The Cienfuegos, Palmira & Cinces Electric Power & Railway Company, of Cuba, is about to let contracts for construction materials. Specifications can be secured from C. C. Vermeule, 203 Broadway, New York. Bids will be received up to March 15 for 4,400 tons of steel T-rails (70-pound), spikes, rail bonds, creosoted ties, trolley poles and barrels of Portland cement. The electrical plant for the power house will be contracted for; it is expected, within two months.

The firm of W. H. Coverdale & Co. has been incorporated to do a general engineering and contracting business, with an office at 66 Broadway, New York. The organization includes both mechanical and civil engineers. Mr. Coverdale was for many years in the engineering department of the Pennsylvania Lines West of Pittsburg, and was Track Elevation Engineer of that company in Chicago during 1898-99. For the last three years he has been civil engineer for a New York firm of engineers and contractors.

A report from Birmingham, Ala., announces the organization of the Southern Steel Car Manufacturing Company, with an authorized capital of $500,000. The works will be located at Ensley, Ala., where 10 acres of land has been bought. Construction work will begin at once, contracts having been signed Jan. 27. The company expects to employ 300 men to start with. Virginia and New York capitalists are interested in the enterprise. W. G. Pilkinton, of Virginia, is president and J. W. Gilliam secretary and treasurer.

Contracts have been let for the equipment of the new locomotive shops now under construction at Sayre, Pa., by the Lehigh Valley. The capacity of the power plant will be 8,000 h. p. The Westinghouse Electric & Manufacturing Co. secured the contract for the generating equipment, and McIntosh, Seymour & Co. will build the engines. Wickes Bros., Saginaw, Mich., have taken the contract for the boilers. The crane equipment, consisting of 12 cranes, will be installed by the Shaw Electric Crane Company, of Muskegon, Mich. The contract for the ventilating equipment has been let to the Buffalo Forge Company. Ten 10-ft. fans will be installed in the main locomotive shops, each fan driven by 20-h. p. motors, which have yet to be ordered.

Iron and Steel.

According to reports from Montreal, the Pennsylvania Steel Company has taken a contract from the Canadian Pacific for 40,000 tons of 80-lb. rails at $21.50 a ton.

Reports from Jeffersonville, Ind., state that the American Car & Foundry Company will close its shops at Jeffersonville, throwing 2,000 men out of employment.

The large steel works of the Tennessee Coal, Iron & Railroad Company at Ensley, Ala., have resumed work, after a shutdown since the middle of November for repairs.

A consolidation, it is reported, has been formed of the Racine (Wis.) Iron and Steel Company, the Grand Crossing (Ill.) Iron and Steel Company, the South Bend (Ind.) Iron and Steel Company, and the Columbus (Ohio) Iron and Steel Company, with a capital stock of $500,000. Former United States Senator Jones is one of the largest stockholders in the new company.

The American Iron & Steel Association reports that the total production of pig iron in the United States in 1903 was 18,009,252 gross tons, against 17,821,307 in 1902 and 15,373,354 in 1901. The total number of furnaces in blast on December 31, 1903, was 182, against 320 on June 30, 1903, and 307 on December 31, 1902. The number in blast at the end of 1903 was the smallest since December 31, 1896, when 159 furnaces were in blast.

Pressed Steel Car's Year.

The report for the year ending December 31 last shows net earnings were $2,768,898, 1903, as compared with $4,578,114, 1902, and $1,984,062, 1901; and a surplus of $1,008,898 in 1903, as compared with $2,903,114 in 1902, and $409,269 in 1901. The annual meeting of the stockholders will be held on February 17 to elect three directors. The dividend for the last quarter was 1¾ per cent. on preferred and 1 per cent. on common stock.

Pneumatic Signal Co.'s New Orders.

Following is a list of contracts received by the Pneumatic Signal Company during the month ending January 27:

Town.	Railroad.	Levers.
New Castle Junc. Yd., Pa.	Baltimore & Ohio	24
Norfield, Miss.	Illinois Central	2
Abrams, Pa.	Phila. & Reading	32
Kenney, Ill.	Illinois Central	16
St. Joseph, Ill.	Chicago & E. Ill.	44
Elizabeth, N. C.	Suffolk & Carolina	16
Rosamond, Ill.	C., C., C. & St. L.	16
Witt, Ill.	C., C., C. & St. L.	16
Irving, Ill.	C., C., C. & St. L.	16
Ohlman, Ill.	C., C., C. & St. L.	16
Hillsboro, Ill.	C., C., C. & St. L.	32
World's Fair Grounds	Wabash	56
Union Ave.	Wabash	28
Page Ave.	Wabash	44
Forsythe Junction	Wabash	44
North Beddick, Ill.	Wabash	16
Howard, Ill.	Wabash	16

THE SCRAP HEAP.

Notes.

A firm in Houston, Texas, has made a shipment of 3,600 bales of cotton to Japan by way of San Francisco. The shipment weighed 949 tons, and took 41 cars. It went over the Southern Pacific.

The Pennsylvania Railroad is now running 12 or 15 freight trains each way daily between Philadelphia and

Pittsburg without change of engines and without switching at division terminals. The crews change at Altoona and Harrisburg, as in the case of other trains.

The newspapers say that the postmaster at Indianapolis has been ordered to refuse to deliver mail to Charles B. Chrysler, Manager of the "American Railway School." It is alleged that Chrysler's enterprise is fraudulent, designed to secure money from young men in the country without giving them value in return.

Conductors and enginemen on the Southern Railway receive annual passes as follows: Those who have served five years will get them over their divisions. Ten-year men are to receive annuals for the entire system east of the Mississippi River, and 15-year men will get them for themselves and wives. More than 1,000 engineers and conductors are affected.

The Chicago & Alton is to do extensive work in beautifying the stations on its main lines, preliminary to the St. Louis World's Fair, and landscape gardeners are drawing up plans. Work will be begun as soon as the weather will permit. According to a St. Louis paper, several ladies who are expert landscape gardeners have been engaged to supervise the work.

The New York Produce Exchange and the New York Board of Trade & Transportation have adopted reports opposing the passage of the bills now before Congress for enlarging the power of the Interstate Commerce Commission. The friends of these bills report from Washington that hearings on them will be given by the House Committee, but no information is given as to when the hearings will be held.

A report from Huntington, Ind., says that the Superintendent of the Chicago & Erie and a road foreman of engines of the same road have been arrested on the charge of violating the law of the state forbidding officers to keep enginemen at work excessive hours. The complaint was made by an engineman who had been discharged, and who alleged that he was kept on his engine more than 16 hours.

A press despatch from Kansas City says that the railroads there, as an offset to the action of the Southwestern lumbermen in trying to promote a law to require railroads to pay a forfeit to the consignee when freight is not promptly transported, have notified the lumbermen that hereafter their freight bills must be paid on demand, or the railroads will refuse to deliver or reship freight until after the payment of charges.

It is said that the Southern Pacific received during the year 1903 over $57,000 in fares paid by passengers who boarded the trains of the company with tickets which were not good, or were attempted to be wrongfully used. These tickets, numbering over 2,000, were taken up by conductors on trains out of Portland, Ogden, San Francisco, Sacramento, Los Angeles and El Paso. This indicates in some degree the extent of the business done by ticket scalpers in the cities named.

A committee of General Passenger Agents has recommended that reduced rates to the World's Fair at St. Louis be made on the following basis: 1. A season excursion rate to St. Louis, beginning April 25 and continuing until November 30, at 80 per cent. of double the one-way fare. 2. Excursion rates, with final return limit of 60 days, at rate of one and one-half. 3. Excursion tickets of ten days' limit, in territory within 200 miles of St. Louis, at rate of one fare plus $2. 4. That excursions be run not oftener than one day each week by each line, at rates and with limits and other conditions as may be agreed upon by interested lines.

The Atchison, Topeka & Santa Fe last week announced a reduction of five cents per 100 lbs. in the rate on grain from interior Kansas points to Galveston. This was promptly followed by similar action on the part of the Missouri Pacific and the Rock Island, and on Friday grain for export could be shipped from Omaha for 9 cents per 100 lbs. less by way of the Gulf of Mexico than by the lines to the Atlantic seaboard. The action of the Chicago Great Western in making low rates from Omaha eastward to Chicago, and also to Duluth, St. Paul and Minneapolis, has resulted in reductions by all of the lines from Omaha and Kansas City eastward, and the rate from Kansas City to Chicago is now 12 cents per 100 lbs. on wheat and 11 cents on corn. Press despatches indicate that the rate on grain to New Orleans has been already, or will be, reduced to correspond with the Galveston reduction.

Regulating Live-Stock Trade.

A press despatch from Chicago says that solicitors to the number of 1,000 have been called off the road by the live-stock commission houses of Chicago, Kansas City, Omaha, St. Louis and Sioux City. This is the result of recent balloting by members of the live-stock exchanges. Many Chicago houses have branches at other markets. The agreement provides that members of firms cannot solicit business in person on the road more than six days in one month. Telegrams and telephone messages cannot be paid for by the commission men unless they concern actual shipments. The practice of furnishing meal tickets for shippers of live-stock is also forbidden, but a member of a firm can take a customer to dine. The reforms, it is estimated by the live-stock men, are equal to a saving of $2,750,000 a year.

C. & O. Coal-Rate Decision.

Judge McDowell, in the United States Circuit Court for the Western District of Virginia, has decided in favor of the Government in the case of the Interstate Commerce Commission against the Chesapeake & Ohio and New York, New Haven & Hartford Railroads, instituted on the complaint of W. C. Bullitt, a coal broker of Philadelphia, for alleged unlawful discrimination in freight rates made by the Chesapeake & Ohio. The C. & O. undertook to deliver to the New Haven 2,000,000 tons of coal, in quantities not to exceed 400,000 tons per annum, within the five years beginning July 1, 1897, and ending July 1, 1902, at $2.75 per ton, delivered at New Haven. At the end of the five-year period there was a shortage of about 60,000 tons in the deliveries of coal, occasioned by the coal strike of 1902, and the New Haven road claimed damages for the shortage amounting to $103,910.69, which claim was settled by an agreement to complete the delivery at the price stipulated in the contract. When these proceedings were begun this agreement had not been fully carried out.

The charge of discrimination is based on the allegation that the Chesapeake & Ohio cannot deliver coal at the agreed price and realize its regular freight charges on the coal carried. Both of the defendant companies deny that any unlawful discrimination was intended in their contract, or resulted from it. Similar contracts have frequently been made by the Chesapeake & Ohio and other railroads, and, though generally known to the coal dealers, including Mr. Bullitt, they have not heretofore been attacked as illegal.

The contract referred to was negotiated in 1896 by M. E. Ingalls, formerly President of the Chesapeake & Ohio, and was intended in part not only to furnish traffic for the railroad company, but to develop coal operations by furnishing a market for coal. Since the contract was made freight rates and the price of coal have advanced, and conditions have otherwise materially changed. The agreement immediately in question in this suit is that by which the claim for damages against the C. & O. for failure to complete its contract was settled; by this agreement the C. & O. was not only to receive the contract price for the coal delivered, but was to be discharged from a large claim for damages.

In his opinion Judge McDowell decides that the Chesapeake & Ohio has been guilty of giving to the New Haven road an undue preference, and continues the temporary injunction. The facts in the case are said to be unlike those in any case heretofore decided. In brief, the ruling is that an interstate carrier cannot buy articles of transport, carrying them over its line, from state to state, and deliver them to one purchasing such articles from the carrier at less than the aggregate of the cost of the article and the published freight rate of the carrier. Even where such transaction was not designed to evade the act, it is held that there is an advantage, equal to the loss suffered by the carrier, given to the purchaser which other purchasers are not given. If this advantage is substantial and sufficient in amount to be undue or unreasonable, it is held to be forbidden by the third section of the act. It is understood that an appeal will be taken by the railroad companies.—*Baltimore Herald.*

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page 16.)

Car Foremen's Association of Chicago.

The regular meeting will be held at Masonic Temple, Chicago, Feb. 10, at 8 p. m. There will be a discussion of the report of committee on Interstate Commerce Commission accident reports, and of Mr. Willcoxson's paper on Heating Passenger Trains; also rules governing the heating of trains.

New England Railroad Club.

At the meeting of this club, to be held in Boston, Tuesday evening, Feb. 9, it is expected that Mr. Edward A. Moseley, Secretary of the Interstate Commerce Commission, will be present to speak upon the Safety Appliance Act, and also that accounts will be given by some of the Commission's inspectors of their experience in enforcing the law.

PERSONAL.

—Mr. H. Swoyer, for some time past Assistant Superintendent of Machinery of the Louisville & Nashville at Louisville, has been appointed Assistant General Manager of the Rogers Locomotive Works, Paterson, N. J.

—Mr. Richard S. Buck has been appointed Consulting Engineer in the Bridge Department of New York City, and will find himself quite at home among his old associates. On May 1, 1902, he resigned the office of Principal Assistant Engineer in the same department, and has since then been Chief Engineer of the Dominion Bridge Company, of Montreal, Canada.

—Mr. William H. Gordon, who died at his home in East Millstone, N. J., January 25, at the age of 80, was one of the oldest employees of the Pennsylvania Railroad, having been retired on a pension January 1, 1900, after a service of almost 55 years. Mr. Gordon was a locomotive engineer and had 22 near relatives engaged in same kind of work. He ran a passenger train between Millstone and Jersey City continuously for 44 years. At one time his engine was the "John Bull," the primitive machine that the Pennsylvania Railroad exhibited at Chicago in 1893. His father, Samuel Gordon, ran the first steamboat between New York and New Brunswick.

—Mr. R. J. Farrell, Master Mechanic of the Illinois Southern, at Sparta, Ill., goes from Nashville, Tenn., where, since 1902, he has been Master Mechanic of the Tennessee Central. Mr. Farrell's railroad service dates from 1886, when he began as machinist on the Louisville & Nashville. Two years later he was made foreman at Knoxville for the East Tennessee, Virginia & Georgia (Southern), and remained with the company as foreman and general foreman of shops until August, 1901, when he resigned to go to the Seaboard Air Line as Master Mechanic at Raleigh in charge of the Second and Third Division. In April, 1902, he left this road to go to the Tennessee Central, which road he now leaves to become Master Mechanic at Sparta.

—Mr. W. H. Brimson, Superintendent of the Baltimore & Ohio Southwestern at Chillicothe, who goes to Cincinnati as General Superintendent of the road to succeed Mr. Carothers, has been in railroad service since early manhood. After leaving school he began railroad work at Norwalk, Ohio, in the telegraph department of the Cleveland & Toledo, now a part of the Lake Shore, and later became Chief Despatcher. He was then appointed Trainmaster and Superintendent of Telegraph of the Cincinnati, Sandusky & Cleveland, and afterward became Superintendent. Later he went to the Duluth & Iron Range, as Superintendent, and from there to the Pacific Division of the Northern Pacific. Here he was Superintendent and afterward was transferred to the Rocky Mountain Division. Mr. Brimson organized and put into operation the Brainard & Northern Minnesota, and later became that company's General Superintendent. He went from the Northern Pacific to Chillicothe about seven years ago.

—Mr. John G. Walber, the new Assistant to the General Manager of the Baltimore & Ohio Southwestern, began his railroad service on the Ohio & Mississippi in 1885. The next year he was made a clerk in the office of the President and General Manager, later becoming private secretary. At the time of the consolidation of the Ohio & Mississippi and the Baltimore & Ohio Southwestern, Mr. Walber was made Secretary to the Second Vice-President and Traffic Manager, with office at St. Louis, where he remained until the office was abolished in 1896. In March of that year he was made chief clerk in the Vice-President's and General Manager's office of the consolidated road. In November, 1902, he was elected Assistant Secretary of the company, which office he will continue to hold in addition to being Assistant to Mr. Greene.

—Mr. James C. Cassell, who has been Assistant to the General Manager of the Norfolk & Western for several months past, has been appointed Assistant to the President. In other words, the promotion of Mr. Johnson from the position of General Manager to that of President is accompanied by a similar promotion for his assistant. Mr. Cassell has been with the Norfolk & Western more than 25 years, but about one year ago had to give up his duties as General Superintendent to go to Europe and the West Indies on account of his broken health. This extended vacation produced material improvement and on his return he was made Assistant to Mr. Johnson. Mr. Cassell is 48 years old and began his railroad service on the Pennsylvania as a telegraph operator. On the Norfolk & Western he was steadily promoted from Chief Train Despatcher to the positions of Trainmaster, Superintendent and General Superintendent. He is a member of the Car Service Committee of the American Railway Association.

—Mr. A. C. Needles, who succeeds Mr. Maher as General Superintendent of the Norfolk & Western, was born in Baltimore, Md., January 10, 1867. After attending Swarthmore College he entered the service of the Norfolk & Western as a rodman. This was in 1884. In a short time he was transferred to the transportation department as yard clerk at Roanoke, Va., and served successively as brakeman, assistant yard master and yardmaster, and later was appointed yardmaster at Pulaski, Va., and then at Bluefield, W. Va. In 1890, he was made Assistant Trainmaster of the Pocahontas Division and remained in that position until 1898, when he was transferred to the Radford Division in a similar capacity. Later he was made Trainmaster of that division. In 1901, he was appointed Assistant Superintendent of the Pocahontas Division, and in the same year was transferred to the Shenandoah Division as Superintendent. The next year (1902) he was made Superintendent of the Norfolk Division, and in a few months became Superintendent of the Pocahontas Division, where he remained until his new appointment as above.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—The annual meetings of the stockholders of the Central Ohio Railroad, the Eastern Ohio Railroad, the Columbus & Cincinnati Midland, and the

Sunday Creek Railway Company, subsidiary companies of the B. & O., were held January 28, and Oscar G. Murray was elected President of all the companies; F. A. Durbin, of Zanesville, Ohio, recently appointed General Counsel of the western lines of the B. & O., was elected Vice-President of the companies in which Mr. Murray previously held that office, and was also elected a Director in all the companies. Fred Lazarus was elected a Director in the Columbus & Cincinnati Midland, succeeding the late Ralph Lazarus.

George H. Campbell, hitherto Assistant General Superintendent, has been appointed General Superintendent, with office at New York, succeeding G. F. Randolph.

A. P. Prendergast, hitherto Master Mechanic at Grafton, W. Va., has been transferred to Riverside, Baltimore, as Master Mechanic, succeeding O. J. Kelly, who has been transferred as Master Mechanic at Parkersburg, W. Va.

O. H. Hobbs has been appointed Superintendent of Terminals at Washington, D. C.

Bangor & Aroostook.—G. M. Houghton, Traffic Manager, has been appointed General Manager.

Central of Georgia.—C. L. Bruner, Superintendent of the Second Division, at Macon, Ga., has resigned.

Chicago, Milwaukee & St. Paul.—James Connors has been appointed District Master Mechanic of the Southern District, with headquarters at Dubuque, Iowa, succeeding George H. Brown, assigned to other duties. David Patterson has been appointed General Foreman, Locomotive Department, with headquarters at Marion, Iowa, succeeding Mr. Connors.

E. W. McKenna has been appointed Assistant to the President, with headquarters at Chicago, Ill. J. N. Barr, the present Assistant, has been granted leave of absence for six months.

Chicago, Rock Island & Pacific.—Since Monday, February 1, the authority of General Manager H. I. Miller has extended over the Southwestern District.

Delaware & Hudson.—W. L. Lawrence has been appointed Acting Real Estate Agent, succeeding C. S. Weston, resigned.

J. H. Hyde has been elected a Director.

Erie.—Oscar F. Georgi has been appointed Claims Attorney, with office at New York. Herbert A. Taylor becomes Assistant to the General Solicitor.

Grand Trunk.—C. S. Cunningham has been appointed Joint Superintendent of the Southern Division (joint, Grand Trunk and Wabash), with headquarters at St. Thomas, Ont., succeeding L. J. Ferritor, resigned. F. W. Egan has been appointed Assistant Superintendent, in charge of Transportation and Station Service, of the First, Second and Third Districts of the G. T., with headquarters at Island Pond, Vt., succeeding J. W. Higgins.

Lehigh Valley.—R. S. Dousman has been appointed Auditor of Traffic, with office at Philadelphia, Pa. The offices of Auditor of Coal Traffic, Auditor of Freight Receipts and Auditor of Passenger Receipts have been abolished.

Louisville & Nashville.—Master Mechanic C. F. Giles having been made Assistant Superintendent of Machinery, J. G. Clifford, Master Mechanic at South Louisville, Ky., has been transferred to Louisville, with jurisdiction over both places. J. J. Reid has been appointed General Master Mechanic, with headquarters at Louisville, succeeding A. Beckert, resigned. Henry Hardie, hitherto General Foreman at Corbin, Ky., has been promoted to be Master Mechanic of the Knoxville and Cumberland Valley Divisions, with headquarters at Corbin.

Minneapolis, St. Paul & Sault Ste. Marie.—George C. Conn, hitherto Assistant General Freight Agent of the Pere Marquette, has been appointed General Freight Agent of the M., St. P. & S. S. M., with headquarters at Minneapolis, Minn.

Mississippi Railroad Commission.—S. D. McNair has been elected President and T. R. Maxwell succeeds Mr. John A. Webb as Secretary.

New York, New Haven & Hartford.—The Telephone and Telegraph Departments have, since February 1, been consolidated and placed under the supervision of N. E. Smith, Superintendent of Telegraph, with headquarters at New Haven, Conn.

Norfolk & Western.—James C. Cassell, previously Assistant to the General Manager, has been appointed Assistant to the President.

Northern Pacific.—T. J. Cutler, hitherto Master Mechanic at Fargo, N. Dak., has been appointed Master Mechanic of the Rocky Mountain Division, with headquarters at Missoula, Mont., succeeding W. F. Buck.

Peoria & Pekin Terminal.—G. W. Talbot, hitherto Traffic Manager and General Superintendent, has been appointed General Manager, with headquarters at Peoria, Ill., succeeding L. E. Myers. Mr. Talbot continues in direct charge of all traffic matters. E. A. Burrill, hitherto Assistant Superintendent, has been appointed Superintendent, with headquarters at Peoria, Ill. The office held by Mr. Burrill has been abolished.

Pennsylvania Company.—J. W. Barrie, hitherto Assistant Engineer at Chicago, has been appointed Engineer of Maintenance of Way of the Toledo Division; Cooper Wood, Assistant Engineer at Pittsburg, becomes Engineer of Maintenance of Way of the Indianapolis and Vincennes Division, and W. D. Wiggins has been appointed to succeed Mr. Geer as Engineer of Maintenance of Way of the Pittsburg Division (Southwest System).

Pere Marquette.—George C. Conn, Assistant General Freight Agent at Milwaukee, Wis., has resigned. (See Minneapolis, St. Paul & Sault Ste. Marie.)

Pittsburg & Lake Erie.—E. H. Kennedy, previously Assistant Auditor, has been appointed Auditor, with headquarters at Pittsburg, Pa., succeeding C. H. Bronson, resigned.

Public Service Corporation.—W. W. Wheatly, General Manager of the street railway department, with headquarters at Newark, N. J., has resigned. Albert H. Stanley has been appointed General Superintendent.

St. Louis, Brownsville & Mexico.—At a meeting held recently S. W. Fordice, B. F. Yoakum and T. H. West were elected Directors. Mr. Yoakum and Mr. West succeed J. B. Wells and F. G. Jonah, retired.

Seaboard Air Line.—A. W. Towsley has been appointed Assistant to the President, with headquarters at Portsmouth, Va., succeeding Colonel T. M. R. Talcott, resigned. W. R. Hudson, hitherto Superintendent of the Fourth Division, has been transferred as Superintendent of the Second Division, with headquarters at Raleigh, N. C., succeeding Mr. Towsley, and Mr. Hudson, in turn, is succeeded at Jacksonville, Fla., by W. J. Jenks.

Southern.—H. A. Williams has been appointed Superintendent of the Savannah Division, with headquarters at Columbia, S. C., succeeding P. I. Welles, resigned. A. Gordon Jones has been appointed to succeed Mr. Williams as Superintendent of the Norfolk Division, with headquarters at Pinners Point, Va.

Wabash.—See Grand Trunk.

Wheeling & Lake Erie.—C. A. Van Dusen has been appointed Assistant Superintendent of the First and Third Districts, Toledo Division, and Toledo Terminals, with headquarters at Cherry Street Depot, Toledo, succeeding H. W. McMaster, who has been appointed Assistant Superintendent of the Cleveland Division, with headquarters at Canton, succeeding Mr. Van Dusen.

White Pass & Yukon Route.—R. D. Pinneo has been appointed Assistant General Freight and Passenger Agent, with headquarters at Skaguay, Alaska.

LOCOMOTIVE BUILDING.

The Lehigh Valley is reported to be in the market for 40 locomotives.

The Lehigh & New England is having three locomotives built at the Baldwin Works.

The Norfolk & Southern is having two locomotives built at the Baldwin Works.

The Wiggins Ferry Company, St. Louis, is having three locomotives built at the Baldwin Works.

The Lake Shore & Michigan Southern is reported to be in the market for 40 locomotives.

The New York Central & Hudson River has ordered 70 locomotives from the American Locomotive Company.

The Ulster & Delaware is having three locomotives built at the Schenectady Works of the American Locomotive Company.

The Toledo, St. Louis & Western, as reported in our issue of Jan. 29, is having two locomotives built at the Brooks Works of the American Locomotive Company. These locomotives are to be Atlantic (4-4-2) type, for April, 1904, delivery; cylinders, 19 in. x 26 in.; diameter of drivers, 73 in.; extended wagon-top boiler, with a working steam pressume of 225 lbs.; Otis steel fire-box, 105 in. long and 66 in. wide; tank capacity, 5,000 gallons of water and coal capacity, 10 tons. Special equipment includes: Westinghouse air-brakes, Taylor iron axles, Magnesia boiler lagging; National-Hollow brake-beams, Tower couplers, Pyle-National electric headlights, Ohio injectors, Damascus journal bearings, Jerome piston rod and valve-rod packings, Ashton safety valves, Leach sanding devices, Gould steam heat and cast steel wheel centers.

The New York, Chicago & St. Louis, as reported in our issue of January 29, is having five locomotives built at the Brooks Works of the American Locomotive Company. These locomotives are to be simple (2-4-0) type, for March, 1904, delivery. The locomotives will weigh 160,000 lbs., with 142,000 lbs. on the drivers; cylinders, 19 in. x 28 in.; diameter of drivers, 62 in.; radial stay fire-box boiler, with a working steam pressure of 200 lbs.; heating surface, 2,530 sq. ft.; 306 charcoal iron tubes, 2 in. in diameter and 14 ft. 10 in. long; fire-box, 96 in. long and 63 in. wide; grate area, 40.9 sq. ft.; tank capacity, 5,500 gallons of water and coal capacity, 14 tons. Special equipment includes: Westinghouse air-brakes, steel axles, Sterlingworth brake-beams, Tower couplers, Star headlights, Monitor injectors, Magnus journal bearings, United States piston-rod packings, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel-Spring Co.'s springs, Crosby steam gages, Midvale driving wheel tires and cast steel wheel centers.

CAR BUILDING.

The Grand Trunk is reported to be in the market for 1,000 freight cars.

The Pere Marquette has ordered 10 coaches from the American Car & Foundry Company.

The Wabash has ordered 11 passenger coaches from the American Car and Foundry Company.

The Queen & Crescent has ordered three postal cars from the American Car & Foundry Company.

The Canadian Northern has ordered 150 freight cars from the Crossen Car Company, Cobourg, Ont.

The Lehigh Valley has ordered 100 cars from the Standard Steel Car Company. The company is also reported in the market for a large number of box cars.

The Minneapolis, St. Paul & Sault Ste. Marie, as reported in our issue of January 15, has ordered 300 box cars of 60,000 lbs. capacity from the American Car & Foundry Company, for September delivery. The cars will be 34 ft. 3⅞ in. long, 8 ft. 4⅜ in. wide, and 8 ft. ¼ in. high, all inside measurements. The special equipment includes: Iron axles and Washburn couplers.

The City of Winnipeg is asking bids on 25 hopper gondola cars of 80,000 lbs. capacity. These cars must be 30 ft. long x 8 ft. wide, and must be strictly self-discharging. Separate price for air-brakes. Bids will be received until 8:30 p. m. on Feb. 9, and plans and specifications must be submitted with bids. Date of delivery not later than May 31. Each bid must be accompanied by a check or cash deposit of $1,000. Address C. J. Brown, City Clerk's Office, Winnipeg, Manitoba.

The Delaware, Lackawanna & Western, as reported in our issue of January 29, is in the market for 1,000 standard box cars of 60,000 lbs. capacity and 500 hopper cars of 80,000 lbs. capacity. The box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The hopper cars will be 31 ft. 6 in. long, 10 ft. wide and 9 ft. 10 in. high, to be built of steel. The special equipment will include: Steel axles, metal bolsters and brake-beams, Westinghouse air-brakes, steel couplers and arch bar trucks.

BRIDGE BUILDING.

ALABAMA.—The House of Representatives, on Jan. 27, passed bills authorizing the Mobile & West Alabama to build bridges over Tombigbee River, between the counties of Clarke and Choctaw, Ala., and over Warrior River, in Tuscaloosa County, Ala.

ATWOOD, ONT.—Thomas Fullerton, Clerk of Elma Township, is receiving bids up to Feb. 15 for culverts and bridges.

BELVIDERE, N. J.—The Belvidere Bridge Company, it is reported, will rebuild a number of bridges over the Delaware River destroyed by floods.

BOSTON, MASS.—Bids are wanted, Feb. 8, by the Metropolitan Park Commission for building the steel superstructure of a bridge over the Boston & Maine tracks, Saugus Springs, Revere Beach Parkway, Everett. William T. Pierce is engineer.

A bill is to be introduced in the Senate providing for the building of a new bridge over the Charles River, to connect Boston and Cambridge.

BOWLING GREEN, OHIO.—The Board of County Commissioners of Wood County, it is reported, will build a bridge over Grassy Creek, to cost about $100,000.

BRIDGEPORT, IOWA.—A contract has been given to the Clinton Bridge Company, of Clinton, Iowa, to build a steel bridge 240 ft. long over Cedar Creek for joint account of Lee and Des Moines counties. A. H. Bell, County Auditor, Burlington, Iowa.

BUFFALO, N. Y.—There is a proposition to vote on the question of bonding this city for $1,000,000 and Grand Island for $100,000, the proceeds of the bonds to be used to build the Grand Island Bridge.

EMPORIA, KAN.—Bids are wanted, Feb. 10, by the County Commissioners, for building a number of bridges on tubular or stone piers in Lyon County.

FREDERICTON, N. B.—The Provincial Government wants bids for rebuilding Qarlee Brook Bridge, Perth Centre, also Saddler's Mill Bridge, Parish of Perth.

GAYLESVILLE, ALA.—A new steel bridge is to be built over the Chattanooga River, for which the foundations are completed.

GREAT FALLS, MONT.—The City Council has decided to repair the First avenue N. wagon bridge over the Missouri River, at an estimated cost of $10,000. D. L. Ellis is City Engineer.

INDIANAPOLIS, IND.—Bids are wanted, Feb. 15, by City Comptroller Dunn, for $40,000 of bridge bonds, the remainder of the $65,000 required to complete the Northwestern avenue bridge over Fall Creek.

KANKAKEE, ILL.—Bids may soon be asked by Henry Beckman, Mayor, for building a steel and concrete bridge over the Kankakee River, to cost about $45,000.

KEWAUNEE, WIS.—New piers and abutments for the Sturgeon Bay bridge of the Almapee & Western are to be built and the superstructure lengthened, at a cost of about $50,000.

LOUISIANA.—A bill was introduced in the Lower House of Congress, Jan. 25, authorizing the Little Rock & Monroe Ry. Co. to build a bridge over Ouachita River, in Louisiana, at a point between Ouachita City and Bayou Loutre.

MELROSE, MONT.—Bids are wanted, Feb. 15, by W. M. Oliver, chairman of the County Commissioners at Dilan, Mont., for building a new bridge over the Big Hole River at Melrose, Mont.

MILWAUKEE, WIS.—The North-Western has a plan under consideration for eliminating grade crossings at Kinnickinnic avenue, Becher street, Lincoln avenue and the Chicago road. The total cost of the improvements will be about $650,000.

Bids are wanted, Feb. 23, by the Board of Public Works, for building a highway bridge over the Chicago & North Western at Bartlett street. Charles J. Poetsch is Commissioner of Public Works.

MINNESOTA.—The United States Senate, on Jan. 25, passed the bill authorizing a bridge over the Thief River, in Minnesota. (Jan. 8, p. 33.)

MONTGOMERY, ALA.—The U. S. Senate, on Jan. 27, passed a bill to revive and amend a bill authorizing the Montgomery & Autaugo Bridge Co. to build a bridge over the Alabama River, near Montgomery, which has expired by limitation.

MORAVIA, PA.—A number of bridges were recently washed away by high water in Lawrence County, including a steel bridge 450 ft. long, recently built at a cost of $17,000.

NAPA, CAL.—Bonds, it is reported, have been issued for $35,000, part of the proceeds of which will be used for building two bridges.

NATCHITOCHES, LA.—Bids are wanted, March 1, for building a steel bridge over Old Ferry, at Cypress Station, and a steel drawbridge over Cane River, at Derry; also for protection work to the iron bridge at Grand Ecore. G. W. Kile, President of the Police Bureau.

NILES, OHIO.—Bids are wanted, Feb. 19th, for building the substructure of a bridge to be built over the Mosquito Creek at Robbins avenue.

NOME, ALASKA.—On Jan. 25, the United States Senate passed the bill authorizing the bridge over the Snake River, at Nome, Alaska. (Jan. 22, p. 71.)

PENNSYLVANIA.—In the Lower House of Congress, on Jan. 25, the bill was passed authorizing the Charleroi & Monessen Bridge Co. to build a bridge over the Monongahela River, in Pennsylvania.

PROVIDENCE, R. I.—Bids are wanted, Feb. 17, by the Commissioner of Public Works, for a steel highway bridge over Providence River between Burnside and Exchange bridges; also for a steel superstructure for lengthening the Exchange Bridge.

SAN DIEGO, CAL.—The City Council has directed that bids be asked for building the B street bridges.

SIOUX CITY, IOWA.—The bids received Jan. 26 for the Floyd River bridge were rejected, and new ones are asked Feb. 16. James Lewis, City Engineer.

SULLIVAN, IND.—Bids are wanted, Feb. 19, by the Board of Commissioners of Sullivan County, for building seven steel bridges. J. W. Lang is Auditor.

SYLVANIA, GA.—An iron bridge, about 200 ft. long, is to be built over Ogeechee River.

SYRACUSE, N. Y.—Bids are wanted, Feb. 10, by John C. Kratz, for building a steel bridge 40 ft. long over Lardus Creek for Richard Bros. Gas Company.

TOWANDA, PA.—Recent floods almost totally destroyed the Ulster Bridge, built in 1889, at a cost of $38,800. It was a four-span structure, each span being 234½ ft. long. It may be rebuilt by the state.

WASHINGTON, D. C.—The Senate has passed the bill

for building the Memorial Bridge over the Potomac River from Washington to Arlington.

WAVERLY, OHIO.—A part of the Detroit Southern bridge over the Scioto has been carried away by high water.

YANKTON, S. DAK.—The United States Senate, on Jan. 25, passed the bill authorizing the Winnipeg, Yankton & Gulf Railroad to build a combined railroad, wagon and foot passenger bridge over the Missouri River, at or near Yankton, S. Dak. (Nov. 27, p. 857.)

A bill has been introduced in the United States Senate authorizing the Yankton, Norfolk & Southwestern to build a combined railroad, wagon and foot-passenger bridge over the Missouri River, at Yankton, S. Dak.

YORK, PA.—The Pennsylvania R. R., it is reported, is preparing plans for a steel bridge 210 ft. long over Codorus Creek to replace the Hanover Bridge.

Other Structures.

ANDERSON, IND.—According to reports, the Nicholson File Company, of Providence, R. I., will make improvements to cost about $300,000, and may move its works from Beaver Falls to Anderson.

CHESTER, PA.—The Johnson Frog & Switch Company, according to reports, it removing the old Lamokin car shops and will use the site for its new foundry.

CRAWFORD, IND.—The Consolidated Traction Company may build a large power house early this spring. Edwin Hawkins is president.

DANVILLE, VA.—The Southern, it is reported, will build a new freight house, work on which will be commenced at once.

GUTHRIE, OKLA. T.—The St. Louis & San Francisco is planning to build a two-story brick and stone passenger station, on which work will soon be commenced.

HARRIMAN, TENN.—The Tennessee Central may build shops at Harriman, to take the place of those recently destroyed by fire at Nashville.

KENNEDALE, TEXAS.—The Houston & Texas Central, reports say, will build a new passenger station.

LOGANSPORT, IND.—The Wabash, according to reports, will spend about $200,000 next summer to increase yard facilities and for a new station here.

NAVASOTA, TEXAS.—The Houston & Texas Central and the Gulf, Colorado & Santa Fe, it is reported, have plans ready for a joint union passenger station to cost about $12,000.

NEW HAVEN, CONN.—The New York, New Haven & Hartford, it is reported, will build a new freight house, for which plans have been drawn for a long time.

NEW ORLEANS, LA.—Bids are wanted, Feb. 18, by the Board of Commissioners of the Port of New Orleans, for building the Girod street steel sheds. Hugh McCloskey is President.

ONEIDA, N. Y.—The Oneida Steel Pulley Company will increase its capital from $125,000 to $300,000, and is making plans to build an addition to its works 80 ft. x 80 ft.

SEALY, TEXAS.—The Gulf, Colorado & Santa Fe has under consideration the question of building a new roundhouse, repair-shop station, and making yard improvements at this place, which is the junction with the Cane Belt R. R., recently bought by this company.

SHEFFIELD, ALA.—The Southern Ry., according to reports, is to enlarge its shops here to make cars.

TROY, N. Y.—The paint and upholstering shops of the Delaware & Hudson R. R., at Green Island, have been destroyed by fire at a loss of about $80,000.

WHEELING, W. VA.—The Riverside Bridge Company, of Martins Ferry, will, it is reported, rebuild one of its buildings recently destroyed by fire, with a loss to building and machinery of $50,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BATAVIA & NORTHERN.—At a recent meeting of the directors of this company plans were approved for beginning work on this road in the early spring. The proposed route is from Batavia, N. Y., north through Elba and Albion to Oak Orchard Harbor, 30 miles. C. H. Wight, N. Y., is President, and Richard Schermerhorn is General Manager and Chief Engineer.

CANADIAN PACIFIC.—This company will apply at the coming session of Parliament for authority to build a branch line from a point between Yorkton and Prince Albert in a northwesterly direction to a point in the vicinity of Saskatoon and thence to Wetaskiwin, on the Calgary & Edmonton R. R.

CHICAGO & ALTON.—An officer writes that 38 miles have been graded on the cut-off which this company is building from Mexico, Mo., southeast to Old Monroe, 63 miles. Track has been laid for a distance of 15 miles. The Stubbs Flick Johnson Construction Company is the contractor. (Oct. 16, p. 750.)

CHIHUAHUA & PACIFIC.—The Mexican Government has granted a new concession to this company under the terms of which the time for completing the road is extended three years from Jan. 1, 1904. The road now has under operation about 130 miles of line running from Chihuahua to Minaca.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—Contracts have been let for building a second track from Somerset, Ky., to Norwood, a distance of two miles. An officer writes that this is not the first step in the double grading of the entire road from Cincinnati south, as stated in the local newspapers, but that the track at this point will be used as a siding for freight trains.

DELAWARE, LACKAWANNA & WESTERN.—This company has bought from the Pennsylvania Railroad the old canal, 56 miles long, between Nanticoke and Northumberland, Pa. The canal parallels the Bloomsburg Division of the Lackawanna and will give the company additional space for second tracks, sidings and yards.

DURHAM & SOUTHERN.—Surveys have been begun for this proposed railroad from Durham, N. C., south to Apex, 25 miles. Connection will be made with Cape Fear & Northern at Apex. B. N. Duke, President of the Cape Fear & Northern, is also President of this new road. (Jan. 22, p. 72.)

GULF, COLORADO & SANTA FE.—It is reported that that this company will extend its branch line from Saratoga, Texas, southeast to Batson's Prairie and Sour Lake, a distance of 20 miles. C. F. W. Felt, Galveston, Texas, is Chief Engineer. (Jan. 29, p. 88.)

It is reported that this company is making surveys for an extension from Coleman, Texas, northwest to Portales, N. Mex., 275 miles. C. F. W. Felt, Galveston, Texas, is Chief Engineer.

ILLINOIS & KENTUCKY.—This company has been incorporated to build a railroad from a point in Williamson County, Ill., through Saline, Pope and Hardin counties. The names of the incorporators are not stated, but the headquarters of the company are reported to be at Chicago.

INDIANA ROADS.—The Sandusky Portland Cement Company, of Syracuse, is about to build a freight line from its mine near Syracuse, Ind., northwest to New Paris, Ind., six miles. Connection will be made with the Wabash and the Cleveland, Cincinnati, Chicago & St. Louis at New Paris. Rights of way have been secured and surveys have been completed. Grading will be begun as soon as the weather permits.

KANSAS, ELK CITY & TEXAS.—At a recent meeting of the directors of this company it was voted to begin grading about May 1. The proposed route is from Kiowa, Kan., southwest through Elk City, Okla. T., to Eagle Pass, Texas, 300 miles. I. C. Townsend is President and E. M. Scannel Secretary. The headquarters of the company are at Elk City, Okla. T. (Jan. 22, p. 72.)

LACKAWANNA & WYOMING VALLEY (ELECTRIC).—Press reports state that this company will soon begin work on a tunnel 4,000 ft. long under the city of Scranton, Pa. The object of the tunnel is to enable the company to haul the heavy freight trains out of Scranton over a one per cent. grade. The surface tracks which run out of Scranton towards Pittsburg at present are on a four per cent. grade, which prevents the economical hauling of heavy freight trains by steam locomotives. (June 12, p. 460.)

LUXORA, EVENING SHADE & NORTHWESTERN.—This company has been incorporated in Arkansas. It is proposed to build a railroad through Mississippi, Craighead and Sharp counties, all in Arkansas. J. B. Driver, Luxora, Ark., is President, and M. W. Connelly, Memphis, Tenn., is Secretary.

MEXICAN ROADS.—A concession has been granted by the Mexican government to the Tlacotepec & Huajuapan de Leon Railroad Company to build and operate a railroad from San Marcos to Rosendo Marquez on the Mexican Southern.

The survey for the proposed railroad which the San Carlos Copper Company is about to build from Linares, in Nuevo Leon, Mex., east to San Jose has been submitted to the Mexican government for approval. It is stated that work will be begun at once. Under the terms of the concession the line may eventually be extended south to Soto la Marina, 40 miles.

A company has been organized to build a railroad from Altata, in the State of Sinaloa, Mex., northeast to the mining district of Topia, 80 miles. Surveys are now in progress and contracts for grading will be let in the spring. D. Almada, of Altata, Mex., is interested.

MINIDOKA & SOUTHEASTERN.—Articles of incorporation have been filed by this company in Idaho. It is proposed to build from Minidoka on the Oregon Short Line southwest through Lincoln County to a point on the Salmon Falls River in Cassia County, 85 miles. E. E. Calvin, Salt Lake City, Utah, is President.

MINNEKAHTA & RED CANON.—Articles of incorporation have been filed by this company in South Dakota. It is proposed to build a narrow-gage railroad six miles long in Fall River County. The main office of the company is at Keystone, S. Dak. G. A. Clark, C. J. Patton and others are incorporators.

MOBILE, JACKSON & KANSAS CITY.—Track has been laid as far as Bays Springs, Miss., 27 miles north of Laurel, and grading has been completed as far as Newton, which is 27 miles north of Bays Springs. It is stated that the line will be completed between Laurel and Newton, 54 miles, by March 1. (Dec. 11, 1903, p. 896.)

NATIONAL OF MEXICO.—A contract is reported let to S. M. Robertson, of Monterey, Mex., for building the branch line of this company from Monterey to San Miguel, 75 miles. This line will connect at the latter point with a short railroad from Matamoros, which belongs to the National of Mexico. Nearly 50 miles of grade have already been completed.

NORTHERN PACIFIC.—Press reports state that this company has completed surveys for a proposed extension from Sumas, Wash., to New Westminster and thence to Vancouver, B. C., crossing the Fraser River by the new bridge at New Westminster. The proposed extension will be about 35 miles long. Of this amount 22 miles will be between Sumas and New Westminster, and the remaining 13 by the route of the Vancouver, Westminster & Huron R. R., which is already built.

QUEBEC & LAKE HURON.—An officer writes that the proposed route of this road is from Quebec via Grand Mere, Mattawa, and Lake Nipissing to French River, 450 miles. Work is now in progress between Quebec and Grand Mere, 80 miles. J. C. Cameron, Quebec, is the contractor. (April 10, p. 274.)

RALEIGH & PAMLICO SOUND.—Grading has been begun on this proposed road from Raleigh, N. C., in an easterly direction through Wilson and Greenville to Washington, 95 miles. The character of the work is light, with 1 per cent. grades, and a maximum curvature of 4 degrees. J. M. Turner, Raleigh, N. C., is President. (Jan. 22, p. 72.)

RICHMOND, FREDERICKSBURG & POTOMAC.—The work of double-tracking this line from Richmond to Washington is progressing rapidly. Track has been laid as far as Ashland, 18 miles from Richmond, and between Ruther Glen and Guinea's Station, 20 miles. The viaduct over the South Anna River is completed and the masonry work on the viaduct over the North Anna is well under way. (July 31, p. 562.)

ROGERS SOUTHWEST.—This company has been chartered in Arkansas to build a railroad from Rogers to Siloam Springs, 30 miles. The names of incorporators are not stated.

ST. LOUIS & SAN FRANCISCO.—It is reported that this company will build a branch 23 miles long from Aberdeen, Miss., to Columbus. J. F. Hinckley, 800 Fullerton Bldg., St. Louis, Mo., is Chief Engineer.

ST. LOUIS, BROWNSVILLE & MEXICO.—At a recent meeting of the directors of this company it was voted to increase the capital stock to $3,850,000. Extensions were approved from Sinton, Texas, to San Antonio, 140 miles, and from Sinton to Galveston, 200 miles. The road is now being built from Sinton to Brownsville, 160 miles, and 100 miles of track have already been graded. F. G. Jonah, Corpus Christi, Texas, is Chief Engineer. (Jan. 15, p. 54.)

SANTA FE CENTRAL.—Surveys for the proposed extension of this railroad from Torrence, N. Mex., as far as Roswell, 103 miles, have been completed. It is stated that as soon as eastern money rates are easier, work on this extension will be begun. The road runs at present from Santa Fe, N. Mex., south to Torrence, 117 miles. W. S. Hopwell, of Santa Fe, N. Mex., is General Manager. (Sept. 4, p. 642.)

SOUTHERN PACIFIC.—Press reports state that this company has secured a concession from the Mexican government for building and operating a railroad throughout the peninsula of Lower California. Its southern terminus will be at San Lucan, and the line as projected will run through San Carlos and La Paz.

TENNESSEE CENTRAL.—It is reported that this company will build a branch from Crossville, Tenn., southeast to the Laurel Creek coal fields, 180 miles. W. N. McDonald is Chief Engineer.

TEXAS, SABINE VALLEY & NORTHWESTERN.—An officer writes that surveys are practically completed for an extension from Long View, Texas, north to Gilmer, 16 miles, connecting at the latter point with the Texas Southern at Gilmer. Grading will be begun very shortly by the Grigsby Construction Company, of Dallas, Texas. (Jan. 22, p. 72.)

TONOPAH R. R.—Work is reported in progress on this new railroad from Rhodes, Nev., to Tonopah, 60 miles. McLain & McSweeney, of Tonopah, are the contractors. The character of the work is light, and the contract calls for the completion of the line by January 1, 1905. Paul Eigelhart, of Butler, Nev., is Chief Engineer. (Jan. 15, p. 54.)

WABASH.—Work is to be started at once on a second track from Litchfield, Ill., to Worden, 20 miles, and from Brooklyn, Ill., to Poag, 12 miles. The work is to be completed by June 1, 1904.

WEST VIRGINIA HILLS R. R.—A charter has been granted this company in West Virginia to build from Powells, Marion County, southwest to Buckhannon, 30 miles. This line will connect two branches of the Baltimore & Ohio. W. J. Roderick, F. P. Mills, of Robson, W. Va.; W. O. Wickoff, Flemington, W. Va., and others are incorporators.

YAZOO & MISSISSIPPI VALLEY (ILLINOIS CENTRAL).—Grading has been completed on the extension from Yarbro, Miss., southwest to Swan Lake, 50 miles, and track laying is practically finished. It is stated that the line will be open for traffic by the first of March. McArthur Bros., Chicago, and Lewis N. Jennings, Memphis, Tenn., are the contractors. (June 12, 1903, p. 416.)

GENERAL RAILROAD NEWS.

CHICAGO & ALTON.—The agreement under which Kuhn, Loeb & Co. ask for the deposits of the preferred shares of this railroad says: The bankers, with the approval of the committee, may receive in payment for the deposited shares either cash or the notes of dividend-paying railroad corporations to mature within five years, at not less than 5 per cent. The notes will be secured by pledge of the Chicago & Alton preferred stock. As long as the stock remains on deposit with the bankers, the latter will have the exclusive right of voting power, but the depositors will be entitled to all dividends. If the deposited stock is not sold, the bankers will not be entitled to any compensation, but if the sale is effected, the bankers will receive a commission not exceeding 2½ per cent. on the par value of the stock sold.

GEORGIA, SOUTHERN & FLORIDA.—This road and the Macon & Birmingham have been consolidated under one management, the officers of the former taking control. Although the officers of the Georgia, Southern & Florida have authority over both properties, the Macon & Birmingham will be operated as a separate road for the present. The two companies control a total mileage of 367 miles.

GRAND TRUNK PACIFIC.—It is stated that at the next session of the Dominion Parliament the Grand Trunk Pacific project will be given precedence over all other legislation. Important modifications of the contract with the Grand Trunk Railway regarding the proposed transcontinental scheme will be made.

GREENWICH & JOHNSONVILLE.—This company has been authorized by the New York State Railroad Commission to issue a first mortgage on its property for $500,000. Of this amount $400,000 will be issued at once and the proceeds of the sale will be used to pay for the construction of the Battenkill Railroad.

LONG ISLAND.—Kuhn, Loeb & Co. are about to offer at 99 and accrued interest $10,000,000 refunding mortgage 4 per cent. gold bonds of the Long Island Railroad Company, guaranteed by the Pennsylvania Railroad Company. These bonds are a refunding mortgage on the property of the company. The entire authorized issue is limited to $45,000,000, of which $19,000,000 constitute the present issue, and of the remaining bonds $26,605,000 are reserved to refund or retire other old bonds.

MACON & BIRMINGHAM.—See Georgia, Southern & Florida, above.

NEW ORLEANS TERMINAL.—Harvey Fisk & Sons, of New York, are offering at 93½ and interest a portion of the $3,000,000 of first mortgage 50-year 4 per cent. gold bonds of this company. These bonds are part of an authorized issue of $15,000,000, of which the Standard Trust Company, of New York, is trustee. The bonds are guaranteed by the St. Louis & San Francisco and the Southern railroads. L. S. Berg, New Orleans, is President.

THE PHILADELPHIA, BALTIMORE & WASHINGTON.—At a special meeting of the stockholders of this company, on January 27, it was voted to issue mortgage bonds for $20,000,000, the proceeds to be used to refund outstanding issues and for improvements on the main line between Baltimore and Washington.

VERA CRUZ & PACIFIC.—The National City Bank of New York has filed a bill in the United States Circuit Court to compel the receiver to sell the Vera Cruz & Pacific R. R. and all its securities which are now held by the Maryland Trust Company, of Baltimore. The railroad never yielded any profit to its promoters, and, according to the reports of the engineer, it will be at least two years before it can become a paying investment.